PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY.

HELD AT PHILADELPHIA, FOR PROMOTING USEFUL KNOWLEDGE.

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CONTENTS.

PAGE.

Stated Meeting, September 16 513
Stated Meeting, October 7 514
On Adocus and Laelaps, by E. D. Cope 515
Stated Meeting, October 21 516
On Meteorological Observations by the Amer. Philosophical Society by G. Emerson 516
Stated Meeting, November 4 521
On the Aurora of October 24, by J. C. Cresson 522
On the earthquake of October 20, by G. Emerson 522
Stated Meeting, November 21 523
Obituary notice of James Copland, by Wm. Pepper 525
On Lake Superior Silver Mines, by W. E. Dubois 527
Mr. Cuyler's resolutions respecting an Observatory 528
On the Saurodontidæ, by E. D. Cope 529
On Fresh Water Teritary Fishes of Idaho, by E. D. Cope 538
On the Adocidæ, by E. D. Cope 547
Eighth contribution to the Herpetology of Tropical America 553
Contribution to the Ichthyology of the Marañon, by E. D. Cope .. 559
Stated Meeting, December 2 571
Note on two species of Pythonomorpha, by E. D. Cope 571
Special Meeting, December 9 572
Stated Meeting, December 16 573
On some species of Pythonomorpha from the Cretaceous beds of Kansas, by E. D. Cope 574
Obituary notice of S. V. Merrick, by D. R. Goodwin 584
Obituary notice of Franklin Peale, by Robt. Patterson 597
On three extinct Astaci from Idaho, by E. D. Cope 605
Note on Saurocephalus, by E. D. Cope 608
Note on fossils from West Indian caves, by E. D. Cope 608

End of Vol. XI.

Stated Meeting, September 16, 1870.

Mr. T. P. JAMES in the Chair.

Present, six members.

Letters accepting membership, were received from Dr. William Pepper, dated 1215 Walnut Street, Philad., July 16; Dr. William Boeckh, dated Christiana, Monday, Aug. 11th; Dr. E. R. Beadle, dated 212 south Eighth Street, Philadelphia, Sept. 7th, 1870.

Letters acknowledging the receipt of the Society's publications, were received from the Russian Geographical Society (79, 80); the Austrian Academy (78, 80); the Cambridge Philosophical Society (XI.ii); and the Cincinnati Observatory (82, 83).

Letters of Envoy were received from the Russian Geographical Society; the Austrian Academy; M. Dora d'Istria; and the United States Naval Observatory.

Donations for the Library were received from M. Prudhomme de Borre, of Brussels; the Geographical Society and Cours des Sciences, at Paris; the British Association; London Meteorological and Geological Societies; Cambridge Philosophical Society; Canadian Naturalist; Silliman's Journal; Prof. C. H. Hitchcock; the Medical News; Penn Monthly; Howard University; and the United States Naval, and Cincinnati Observatories.

On motion, the Howard University was placed on the list of correspondents to receive the Proceedings.

On motion, Prof. Cope's "Eight Contribution, &c.," was ordered to be published in the Proceedings. (See page 553).

Pending nominations 651, 652, 654, 655, and new nominations 660, 661, were read.

And the Society was adjourned.

Stated Meeting, October 7th, 1870.

Mr. FRALEY, Vice-President, in the Chair.

Present, sixteen members.

A letter was received from Dr. Goodwin, accepting his appointment to prepare an obituary notice of Mr. Merrick.

A letter acknowledging the receipt of Proceedings 81 and 83, was received from the McGill University, Montreal.

A photograph for the Album was received from Mr. Samuel Foster Haven, of Worcester, Mass.

A letter from M. Carlier, dated Great Coram St., No. 31, near Brunswick Square, London, Sept. 15th, to Mr. Durand, was read, to inform the Society of the fact that he had received the Extrait d'Inscription au Grand Livre, No. 148, 986, Serie 7*éme* rente, 2778; au nom: Philadelphie (La Société Philosophique Americaine), &c.

Donations for the Library were received from the Italian Geological Committee; the London Linnean Society; the Nova Scotian Institute of Natural Science; the Cambridge Museum of Comparative Zoology; and the U. S. R. R. & Mining Register, of Philadelphia.

A donation for the Cabinet was received from Mr. J. A. McNeill, consisting of a Cap worn by the natives of Chiriqui, made of the sheath of the Coible Galen nut.

The decease of Judge Robert C. Grier, a member of the Society, was announced with appropriate remarks, by Judge Strong. On motion of Mr. Price, Mr. Aubrey H. Smith was appointed to prepare an obituary notice of the deceased.

Mr. Cope presented for publication in the Transactions, a Memoir on the Ichthyology of the Antilles, which was referred to a committee consisting of Dr. Leidy, Dr. Bridges, and Dr. Rushenberger.

Dr. Brinton described and proposed the purchase of two rare works now for sale in London—one a Maraho Mexican theological work and grammar, the other a Moska New Granada grammar. The subject was referred to a committee, consisting of Dr. Brinton, Mr. Hopper and Mr. Price.

Mr. McNeil was then introduced by Prof. Cope, and gave a sketch of his explorations in Central America, undertaken for the Peabody Institute, in Salem, and for the Kent Scientific Institute, at Grand Rapids, Michigan, and his plan for a fifth expedition, to explore ruined cities on the river which flows into the Chiriqui lagoon. With $1,200, he could carry on his researches for six months, and send to the Society which employed him, objects of antiquarian, ethnological, and natural history interest.

Dr. Brinton said it was unexplored territory. No stone monuments were known so far south. They were valuable as furnishing possibly a key to the connexion between the Mexican, Central American and Peruvian stone monuments.

Prof. Cope exhibited the remains of a new Cretaceous tortoise, of the genus *Adocus* Cope, to be called *A. syntheticus*. He explained that he had been able to establish more fully the characters of the genus Adocus; that it was found to possess an intergular shield, as in the Pleurodira, but had not the sutural union of the inferior pelvic elements with the plastron, characteristic of that type. These characters had been heretofore known as correlatives in the order, from the Cretaceous period to the present time, and that this genus presented us with the first exception to the rule. The genus was therefore regarded as a generalized type, and typical of a new family, the *Adocidæ*.

He also made some observations on the metatarsal region of *Laelaps aquilunguis*, exhibiting the first example found, and said it proved the distinctness of those elements from each other in that genus, and their slender collective proportions. The specimen was an external one, without trace of a rudimental one on its outer face. That its measurement, 10 inches, was indicative of a length of 18 inches for the median metatarsus, a length he had already assigned to it on theoretical grounds.

Nominations Nos. 651, 652, 654, 655, 660, 661, and new nominations Nos. 662, 663, were read.

And the Society was adjourned.

Stated Meeting, October 21, 1870.

Dr. EMERSON in the Chair.

Present, seven members.

Dr. Brinton stated that the Choctaw Grammar, recently published by the Society, is being translated into German. It appears from two letters recently received from Dr. Berendt, at present prosecuting his researches into the Maya language and history in Central America, that he has added an additional amount of knowledge of the subject equal to that which was possessed before.

Prof. Cope read a paper on the Osteology of Megaptera Bellicosa, one of the few whalebone whales of economic value found within the tropics. He gave a detailed account of the structure of a specimen from the island of St. Bartholomew, W. I., and its variations from known species of Megaptera, especially in the forms of the mandible and nasal bones.

Dr. Emerson read a paper on the part taken by the American Philosophical Society and Franklin Institute in establishing stations for meteorological observations, detailing arrangements for procuring full reports from fifty-two points in the State of Pennsylvania. He spoke of the important bearing which those efforts had had upon the present state of meteorological science.

In February last, the Congress of the United States passed a law for instituting meteorological observations throughout the country by means of Government telegrams. This duty has been assigned to the War Department, and active measures are now in progress to carry out the objects contemplated by the act of our National Legislature.

Through the medium of a pamphlet issued by the Signal Officer appointed by the War Department, we are informed that stations for making observations have already been designated throughout all of our States and Territories, from the Atlantic to the Pacific. By such means, we shall soon be put in possession of data for determining the conditions of the atmosphere over a vast region, and enabled to trace the boundaries and progressive movements of storms and tornadoes, which, generally following definite courses, may have their coming anticipated through storm signals.

Such utilization of simultaneous meteorological observations, with immediate transmission by the magnetic telegraph, is now carried on in England and most parts of Europe, including Norway, Denmark, Holland, Belgium, Prussia, Austria, France, Italy, and throughout the Russian Empire. At your breakfast table in London, Paris, or any other of the principal cities of Europe, you can now read in the *Times*, *Galignani*, and other leading newspapers, the condition of the weather almost at the same hour in the morning, in every part of Europe.

More than thirty years ago, a very active interest was taken in this country, and especially in this city, in regard to meteorological investigations, and especially those relating to the origin and progression of storms. Espy, Redfield, Loomis and Olmstead, on this side of the Atlantic, were the most prominent leaders in the investigations carried on.

The work was not, however, left entirely to individuals, but learned societies engaged in it. In this city, a "*Joint Committee on Meteorology*" was instituted, consisting of four members of this Society and five members of the Franklin Institute, which for several years labored in the collection of observations, and other measures calculated to promote the advancement of meteorological knowledge, and the programme of their plans was almost identical with that now proposed to be carried out under the auspices of Government.

The primary meeting of this "Joint Committee" was held on the 9th of September, 1834, and the first project set on foot by it was the establishment of competent observers, in different parts of our State and country, to make simultaneous observations of the conditions of the weather, the occurrence of storms of rain, hail or snow, the direction of the wind and atmospheric currents, quantities of aqueous precipitations, movements of the barometrical column, temperature, &c.

Of the nine members of this "Joint Committee" when first appointed, I find myself the only survivor; and it seems to me a duty I owe to the Society by which I was appointed, to bear testimony to its former efforts for the advancement of meteorological science—efforts made at a time when the only means of transmission was by the tardy and costly mail service, now superseded by the marvellous capacities combined in the magnetic telegraph.

For carrying out the projects of the "Joint Committee" money was needed. This could not be advanced by our Society, then in a condition of pecuniary embarrassment, nor by the Franklin Institute, which, strange to say, in this great city, where it should be cherished as a grand capitol of the industrial arts creating most of wealth, has always been comparatively poor.

In this dilemma, application was made to the Legislature of our Commonwealth, from which liberal appropriations in money were obtained for our use, $4,000 at one session, and $3,000 at another. Some of this money was used by the "Joint Committee" to defray expenses incurred in printing, corresponding and collecting reports. The largest portion, however, was spent in supplying each of the fifty-two counties then in the State,

with a set of instruments, consisting of a barometer, two thermometers (one self-registering), and a rain-guage.* The manufacture and distribution of these instruments was all entrusted by the Committee to my own supervision. Most, if not all, of these instruments doubtless exist at the present day, in the court-houses or academies in the counties to which they were sent.

At the time to which I refer, I was much devoted to meteorological investigations, and for several years delivered lectures on meteorology, before the class of the Franklin Institute. I made observations several times a day, noting the atmospheric changes as to density, temperature, dew-point, winds, aqueous precipitations, &c. &c. It was whilst so engaged, that I made a communication to this Society, relative to the inapplicability, in this country, of the prognostic words inscribed on the scale-plates of European barometers, such as *fair, set fair, rainy*, &c., which generally indicate the reverse of the prognostic on this side of the Atlantic, where the barometer has never acquired any high degree of credit as a weather-glass. "Stormy" is, perhaps, the only inscription which might be retained for both sides of the Atlantic at or near the sea-level.

In the course of my observations, I found that storms from the north and north-east were generally preceded by high risings in the barometer, especially during the winter months. This observation was recognized as original by Sears C. Walker, a distinguished member of this Society, and by Mr. Espy, who regarded it as one of the main supports of his theory of storms. My communication upon these subjects, I suppose, still exists among the manuscripts in the archives of this Society. In reference to the barometers made for distribution in this State, it is worthy of notice that they do not contain the European inscriptions on their scale plates, "fair," "set fair," &c., which, as I have already stated, are calculated to mislead observers on the western side of the Atlantic, and bring the instrument into discredit. Another reason for omitting the inscriptions exists in the fact, that many of the barometers went to points in the State so greatly elevated as to render deceptive and useless any inscriptions made on scales graduated from the sea level. The main consideration of the Committee was to ascertain the fluctuations of the mercurial column as influenced by atmospheric conditions.

In pursuing his investigations concerning the phenomena connected with the origin and movements of storms, tornados, and water-spouts, Mr. Espy was chiefly indebted for his data to the materials brought together by the labors of the "Joint Committee," from which he was enabled to map the courses of many remarkable storms, hurricanes and water-spouts, which drew marked attention from men of science at home and abroad.

In 1840, Mr. Espy went to Europe, and laid his views before the British

*The original standard barometer and thermometer from which the other instruments were graduated, are now in the possession of the Frank

													Days.
													Hour.
													Temperature of Air.
													Temperature of Wet Bulb.
													Dew Point.
													Course of Wind.
													Lower Strata of Clouds.
													Middle Strata of Clouds.
													Upper Strata of Clouds.
													Strength of Wind.
													Weather.
													Beginning of Rain.
													End of Rain.
													Barometer.
													Observations.

Directions to Observers accompanying First Circular of Joint Committee.

Scientific Association, accompanied by numerous maps and diagrams. His communication elicited great interest, and, after its reading, was discussed by some of the most eminent men in the grand Scientific Congress, among whom were Professors Forbes and Phillips, and Sir David Brewster.

Mr. Espy also visited Paris, and communicated his views to the French Academy, by which a committee was appointed to report upon the subject, consisting of Messrs. Arago, Pouillet, and Babinet. A report was made at considerable length, containing a beautiful analysis of Mr. Espy's theory, with conclusions extremely flattering to our countryman. This, with the paper read before the British Association, may be found in Mr. Espy's treatise on the Philosophy of Storms—a work which contains much of the information collected by the "Joint Committee" in a condensed form.

I cannot conclude this communication without expressing my opinion, that a strong and very effective impulse was given to meteorological investigations at home and abroad by the combined efforts of this Society and its associate, in organizing that system of simultaneous meteorological observations which has since been spread over the European continent, and is now resumed in our own country under the most favorable conditions.

In claiming for our Society the credit fairly due for its efforts formerly made in the cause of meteorology, I do not wish to derogate from the just claims of other institutions or individuals who have been working earnestly in the same field of philosophical research. Any proper notice of even one of these—the Smithsonian Institute, for example—would lead me beyond the just limits of a communication adapted to the usual order of business established by this Society.

The names appended to the first Circular issued in September, 1834, by the "Joint Committee," were

JAMES P. ESPY, *Chairman*,
GOUVERNEUR EMERSON, M. D.,
C. N. BANCKER,
ALEXANDER D. BACHE,
Committee of American Philosophical Society.

JAMES P. ESPY,
ALEX. D. BACHE,
H. D. ROGERS,
S. C. WALKER,
P. B. GODDARD, M. D.
Committee of Franklin Institute.

Mr. Briggs made some remarks on the results in meteorology obtained by Prof. Henry twelve years ago.

Pending nominations, Nos. 662 and 663 were read.

After balloting for Candidates for Membership, the following named gentlemen were declared to be duly elected members of the Society:—

Mr. Henry F. Q. D'Aligny, of New York.
Mr. William P. Blake, of New Haven, Conn.
Mr. George L. Vose, of Salem, Mass.
Mr. J. Imbrie Miller, of Pennsylvania.
Mr. Eckley B. Coxe, of Philadelphia.

And the Society was adjourned.

Stated Meeting, Nov. 4th, 1870.

Vice-President, Prof. CRESSON, in the Chair.

Present, eight members.

Letters were read from Nassau Hall and Yale College, acknowledging the receipt of Proceedings and Transactions.

The following letter was received from the Philadelphia College of Pharmacy, transmitting copies of resolutions adopted by them on the subject of the establishment of a Botanic Garden in Fairmount Park, and asking concurrence, and the appointment of a committee.

PHILADELPHIA, *Nov.* 2d, 1870.

SIR:—

In accordance with instructions, it is my agreeable duty to communicate to you the following action of the Philadelphia College of Pharmacy.

At a Stated Meeting of the Board of Trustees of the Philadelphia College of Pharmacy, held November 1st, the following Resolutions were unanimously adopted:—

"*Resolved*, That a Committee of three be selected to confer with the Park Commissioners, in conjunction with other Committees that may be

appointed for the same purpose, in reference to the establishment of a Botanical Garden in Fairmount Park."

In accordance with the above Resolution, the following Committee was selected :—

Prof. William Proctor, Jr.,
Prof. Robert Bridges, M. D.,
Prof. John M. Maisch.

It was also *Resolved*, "That the Secretary be directed to communicate the action of this College to the President of the Park Commissioners, to the Horticultural Society, and to the American Philosophical Society."

I have the honor to be

Yours, respectfully,

ALFRED B. TAYLOR,
Secretary.

To Prof. GEORGE B. WOOD, M. D.,
President of the American Philosophical Society.

A letter transmitting a donation for the Library, was received from Mr. Abbe, of the Cincinnati Observatory.

Dr. Lea took the Chair, and Prof. Cresson described the recent auroras, of one of which he presented for publication in the Proceedings, the following account:—

An Auroral display occurred on the evening of the 24th of October, observed from half-past eight o'clock. A faint Auroral arch was visible to the north, extending from Cor Caroli, which was just setting, nearly to Castor, which was just rising, the elevation of the arc being equal to that of star Dubhe, in Ursa Major, which was nearly at its lowest culmination. At the same time, a band, of ten degrees in width, of pink auroral light, spanned the heavens, apparently on an arc of a great circle, extending from the northwestern point, where the Northern Crown was setting, to a point in the east, where Bellatrix, in Orion, was just rising, and passing through Menkar, in the head of the Whale, south of Aries, through Pisces and Aquarius, through the Dolphin, through the Eagle, with Altair near the centre of the band, south of Lyra, and through the head of Hercules. The average width of the luminous belt was about ten degrees, its median line corresponding very nearly with the celestial equator.

Dr. Emerson informed the Society that the earthquake of October 20th, 1870, was felt in Canada, the New England States and New York. The strongest manifestations of it were along the St. Lawrence River, and especially on the shores of the Gulf of St. Lawrence, where the shocks were reported so severe as to occasion some loss of life. In certain

quarters of New York city no movements were noticed, but in others shocks were felt to an alarming extent, driving people from their houses and workshops, and children from the public-school rooms, into the street, with a sensation of nausea or sea-sickness. Walls were cracked, clocks were stopped, articles were thrown from tables, steeples vibrated. See detailed account in the Scientific American of October 29th.

Pending Nominations Nos. 661, 662 and 663, and New Nominations Nos. 664 and 665 were read.

Prof. Wood offered the following resolution, which was adopted:—

Resolved, That a Committee be appointed to act with Committees that may be appointed by other Societies, in the matter of procuring the establishment of a Botanic Garden in Fairmount Park.

Prof. H. C. Wood, Prof. Jos. Carson, and Mr. Durand, were appointed said Committee; and, on motion of Mr. Price, the President, Dr. G. B. Wood, was added to the Committee.

By request of Mr. Cuyler, who had been obliged by another engagement to retire from the meeting, Mr. Price asked that notice be given on the cards for the next meeting, that Mr. Cuyler will then present a proposition for the removal of the Society to Fairmount Park, with the view of obtaining an expression of the opinion of the members as to the expediency of such removal.

And the Society was then adjourned.

Stated Meeting, Nov. 21st, 1870.

Vice-President, Mr. FRALEY, in the Chair.

Present, twenty-four members.

Letters accepting membership were received from Mr. Geo. L. Vose, dated Minneapolis, Minn., Nov. 14th, 1870, and Mr. Wm. P. Blake, dated New Haven, Conn., Nov. 18th, 1870.

A letter acknowledging receipt of diploma of membership, was received from Mrs. Mary Somerville, dated Naples, Oct. 26th, 1870.

Letters acknowledging the receipt of the Society's publications, were received from Sir J. F. W. Herschell (series); Mr. R. W. Fox (82); Leeds Phil. Soc. (83); Rhode Island Hist. Soc.; Georgia Hist. Soc.; Peabody Inst.; and Essex Institute (all 84); the Belgian Academy (XIII. 3; and 78, 79, 80, 81); Amherst College (asking for deficiencies to be supplied); New York Lyceum; N. H. Mass. Hist. Soc.; Howard College; New York State Library; and Penna. Hist. Soc. (all XIV, 2, and 84).

Letters of envoy were received from the Belgian Acad., May 30; Holland Soc., July 1st (asking that deficiencies in their series be supplied); Royal Geographical Soc., June 1; and the Ulm Art and Antiquity Union, March 6th, 1869, requesting an exchange of publications. On motion, the Ulm Art and Antiquity Union was ordered to be placed on the list of correspondence to receive the Proceedings.

Donations were received from M. Zantedeschi, of Padua; M. Finzi, of Florence; the Ulm Union; Judge Lowrie; the London R. Astron. Soc.; Mr. John Tyndall; Mr. John Lewis Peyton, of London; Prof. E. Loomis, of Yale College; New York Lyceum N. Hist; Prof. T. Eggleston, Jr.; the Albany Institute; Franklin Institute; and the Minnesota Historical Society; which, on motion, was ordered to be placed on the list of Correspondents to receive the Proceedings regularly.

The Committee to which was referred Prof. Cope's Memoir on the Ichthyology of the Maranon, reported in favor of its being published in the Proceedings, with wood-cut illustrations, which, on motion, was so ordered.

Dr. Wm. Pepper read the following Obituary notice of Sir James Copland:—

OBITUARY NOTICE OF THE LATE JAMES COPLAND, M. D.

Read by Dr. William Pepper, before the American Philosophical Society, Philadelphia, Nov. 21, 1870.

It would be amiss to occupy any large share of the time of the Society by a lengthy eulogy upon the wise man, whose death has furnished the occasion of my remarks; yet in some respects the life of James Copland presented more of variety and vicissitude than falls to the lot of most students or practitioners of medicine. He was born in the Orkney Islands in November, 1791, and was the eldest of nine children. His early education was conducted at Lerwick, one of the Shetland Islands, but at the early age of sixteen, having decided to adopt the profession of medicine, he repaired to the justly renowned University of Edinburgh, where he continued four years. In 1815, at the age of twenty-four, having obtained his diploma, he turned his footsteps towards London, following the example of a long list of distinguished predecessors. It is certainly strong testimony to the high standard of requirements, the great educational facilities, and the distinguished abilities of the Faculty at the University of Edinburgh, during the latter half of the last century, that so many of her graduates attained the highest eminence. It was to this school that we owed our own Kuhn, Rush, Morgan, Shippen, Wistar, and Physick, and many of the most successful and distinguished Physicians in London had migrated there from Edinburgh. Of all these eminent men not one sought the metropolis with a better equipment of vigorous health, strong and well trained mental powers, and indefatigable energy than Copland.

Still he did not succeed in establishing himself there immediately, but within a few months after his arrival in London, crossed the channel to Paris, and spent two years in study at the French and German schools. Upon his return to London in 1817, he became one of the Health officers of the African Company, and spent twelve months on the Gold Coast. While there both his own exceptionally robust constitution and wide experience in the treatment of fever and dysentery, underwent a severe trial, for not only was he obliged to treat and nurse almost the entire ship's crew in an attack of yellow fever, but, after accomplishing this arduous duty, he was himself seized and was dangerously ill. He subsequently returned to England, but after paying a brief visit to his Orcadian home, he again crossed to France and spent some months in attendance on the Parisian Hospitals.

It was not until 1820 that Copland, at the age of twenty-nine years, finally settled in London, and commenced an unbroken course of fifty years' laborious study and practice. From this time his success was steady and uniform. In 1820 he was appointed Physician to the Royal Infirmary for Diseases of Children, a post which he subsequently changed for Senior and finally for that of Consulting Physician. In 1823 he was elected Consulting Physician to Queen Charlotte's Lying-in Hospital. He was also sometime Physician to the South London Dispensary. His practice in-

creased quite rapidly, and for many years before his death was among the largest and most lucrative in London. The professional honors which he received were numerous and distinguished. In 1833 he was made a Fellow of the Royal Society; in 1837 a Fellow of the Royal College of Physicians; in 1838 he was Gulstonian Lecturer; in 1841, 1842, and 1861 he was Censor of the College; Croonian Lecturer in 1844, 1845, 1846; seven times Councillor between 1844 and 1863; Lumleian Lecturer in 1854 and 1855; and Harveian orator in 1857; in 1853 he was elected President of the Royal Medico-Chirurgical Society. He was also honored by being made a member of many learned societies out of England; and in Jan. 17, 1845, was elected a member of the American Philosophical Society at Philadelphia.

Despite, however, the arduous practical duties of his profession he was indefatigable in literary labors. He edited the "London Medical Repository" for five years from 1822 to 1827, and contributed to it a vast number of articles He also edited Richerard's Physiology in 1824; contributed notes to Griffith's translation of Cuvier's "Animal Kingdom;" assisted in the preparation of Annesely's magnificent work on the Diseases of India, to such an extent that it is stated by one well informed that he may be considered its author. His occasional articles are too numerous to mention, but the great work of his life was his colossal "Dictionary of Practical Medicine." The idea of such an enterprise occupied his attention as early as 1827, and he then issued a prospectus of a plan for bringing out an "Encyclopedial Dictionary of Medical Science." The undertaking was not accepted by the publishers, however, though they subsequently entered into an arrangement with Drs. Forbes, Conolly, and Tweedie, which resulted in the publication of an excellent Medical Encyclopedia.

Copland was not to be thus thwarted in his plan, and accordingly in 1830 he began, single-handed and unaided, the task of writing a similar work. The first part of this truly great work appeared in 1832, and others followed in regular succession, so that the greater part of it was published in the first three years, though the last two parts composing the Dictionary did not make their appearance until 1860, twenty-eight years after the first part. The entire work comprises about 7,000 closely printed double-columned royal octavo pages. The success of this publication was immediate and marked. Over 10,000 copies of the English edition were sold, it was reprinted in America and translated into German. It has also been reissued in an abridged form under the editorship of his nephew, Mr. James C. Copland. It is no exaggeration to say that but few more colossal literary works have ever been achieved by any author. The number and variety of the articles are only equaled by the profound erudition and great practical knowledge which they evince, and the vigor and clearness of the style in which they are composed. One of the most important features of the work, and which has endeared it to every true medical student, is the copious and exhaustive Bibliography appended to every article in the Dictionary. In the preparation of these Bibliographic lists, the acquirements and wide range of reading of Copland are conspicuous. The work has served as a

mine from which countless medical workers have extracted precious materials, which they have, in but too many instances, reissued without the stamp of the original and real author. Doubtless many of the theories and views expressed in it will be, ere long, superseded; many of the facts require rearrangement or new explanation; but the work itself will long live and command the admiration of posterity as an enduring monument to the great intellect, sustained ambition, and indomitable energy of James Copland.

In person he was about the common height, of a robust build and striking countenance. In social life he possessed many friends, and was of a most generous and hospitable nature.

For some years before his death he had retired from the active practice of his profession. He had suffered for a long time from gout, and for some years had had occasional attacks of rheumatism. His death occurred on July 12, 1870, in the 79th year of his age, after a severe illness of about ten days.

Mr. Dubois made the following written communication respecting Lake Superior Silver Mines.

Mr. Du Bois asks attention to a specimen of ore from the new silver-mining region on the northern shore of Lake Superior. The precise location of the mine is on a very small island, about half a mile from the main land near Thunder Cape, to the east of Thunder Bay, and north of Isle Royale. Silver Island only measures a few feet long and broad, out of the water, and it was necessary first to fence it with a coffer dam: it is still necessary to use the pump daily. They are now at work a few feet below the bed of the lake.

Herewith two specimens are shown; one is the ore (in two pieces); the other is a button of fine silver extracted from precisely the same amount of ore. The comparison will give an idea of its surprising richness, and will also show how much may be hidden under an exterior not promising to a casual observer.

The matrix is a calcareous spar, or carbonate of lime, with granular galena; the silver occurs in two conditions: mineralized in the galena, and native in small needle-shaped filaments, some of them visible with a glass. The return of this specimen was over $13,000 a ton; but as we are cautious of reporting such ores by such large measure, we gave it as $6.73 a *pound*. However, it turns out that they are really getting up tons of rich ore, and sending it to be smelted at Newark, New Jersey. Other specimens tried at the Mint yield about half as much as the extraordinary piece here shown.

That Lake Superior should thus offer on its northern shore a bed of silver associated with lead; and on its southern shore a mixture of silver with copper, as well as copper alone; is an interesting fact in mineralogy. That it should promise us more silver, at a time when we want it for currency, is equally interesting in another point of view.

The mine, although in Canada, is owned and worked by a company of our citizens, of Detroit and other places.

Prof. Henry made a verbal communication of the doings of the International Commissioners who assembled at Paris last summer, to consider a revision of the French metre.

Mr. Cuyler offered the following Preamble and Resolutions:—

WHEREAS, The Building now owned and occupied by this Society has ceased to be central and convenient, and has also the disadvantage of affording only imperfect and unsafe accommodations to its Library and other valuable properties; whilst those who desire to consult its Books and Manuscripts have not proper conveniences for that purpose; and,

WHEREAS, It has been suggested that it may be practicable to enlarge the field of usefulness of this Society by adding to its other offices that of providing for and controlling the Observatory (both Astronomical and Meteorological), and for the Study and Recording of such other natural phenomena as may be appropriately observed and investigated in connection with such an Institution, and that for these purposes the removal of the Society from its present location, and its re-establishment in Fairmount Park, is desirable and practicable, therefore be it

Resolved, That the President be, and he is hereby, authorized and requested to appoint two Special Committees, each of which shall consist of a Chairman and four other members, and with each of which Committees the President is requested to meet and act as an additional member.

Resolved, That to one of these Committees shall be entrusted the duty of digesting the plan for such an Observatory as is described in the Preamble, so far as, in their judgment, it is expedient this Society should undertake the work of its establishment, and that they be requested also to describe such instruments as it is requisite should be provided for use therein, and an estimate of their cost, together with an estimate of the probable annual expense of maintaining and conducting such an Institution.

Resolved, That the other Committee shall be charged with the duty of considering the financial questions which are involved in such changes as are contemplated by the Preamble and the preceding Resolutions, and of reporting to the Society how the funds requisite for such an undertaking can be provided.

Dr. Carson moved that the further consideration of the Preamble and Resolutions offered by Mr. Cuyler, be postponed to a special meeting of the Society, to be held on the evening of the second Friday in December, notice of which should be given to all the members of the Society, with a printed copy of the Preamble and Resolutions; which was ordered.

And the Society was adjourned.

ON THE SAURODONTIDÆ.

By Edward D. Cope, A. M.

Read before the American Philosophical Society, November 18th, 1870.

The genus *Saurocephalus* of Harlan and its allies have been referred to the neighborhood of the Acanthopterygian family of the *Sphyrænidæ* by Prof. Agassiz in his Poissons Fossiles, after having been regarded by Harlan and Hays as reptilian. This was an important step in the right expression of its affinities; but I take the present opportunity of making another progress in the true interpretation of its relations, favored as I am by the opportunity of examining new material not accessible to former authors. My conclusion, it will be observed, differs widely from that heretofore maintained.

Some years after Harlan's description of *Saurocephalus lanciformis* appeared, Dr. Hays described a second species under the name of *Saurodon leanus*. This I believe to represent a genus distinct from the former. A third genus more remote is characterized in the present article.

The characters of first importance which may be assigned to these genera are:—

Vertebræ short, numerous; their neural arches united with centrum by persistent suture. Tail vertebrated or heterocercal. Superior arch of the mouth formed by the short premaxillaries and long maxillaries. Teeth one-rowed, with fangs received into alveoli more or less confluent at their openings. Anal or caudal radii with complex segmentation.

These characters are most of them entirely contradictory of any affinity to the Sphyrænidæ, those presented by the vertebræ indicating a nearer approach to *Amia*. The structure of the mouth is not that of any Acanthopterygian fish, and with the complex segmentation of some of the radii approaches nearer such types as the Characinidæ. The form of the vertebral centra is utterly different from that of the Sphyrænidæ: in the Saurodontidæ they are short, little contracted medially, and deeply grooved on the sides; in the Sphyrænidæ, elongate, much contracted, and exceptional among Teleosts in being smooth and grooveless!

The characters presented by the teeth and vertebræ of Saurocephalus remind one much of Serrasalmo, though the genus is no doubt in other respects widely removed from that group. On the characters above enumerated, I propose the family Saurodontidæ. Its precise position I am not prepared to determine at present, though I have little doubt that Amia is its nearest living ally. With the remains of species of this group occur numerous scales, which may belong to the former. They are cycloid and without ganoine.

The three genera are distinguished by the form of their jaws and teeth: in *Saurocephalus* the crowns are shortened, much compressed, and with sharp edges; in *Saurodon* the crowns are elongate, subcylindric and slightly curved near the apex. In *Ichthyodectes* the teeth are similar

to those of *Saurodon;* but the margins of both jaws are without the large foramina so prominent in both the other genera. There appear to be some important differences also in the vertebræ, which will be mentioned below.

In the Transactions of the American Philosophical Society for 1856, Dr. Leidy treats *Saurocephalus* as a Sphyrænoid fish, and regards *Saurodon* as a synomyme. He corrects the erroneous references of some European authors, showing the Saurocephalus of Dixon to be a Xiphias, and the Saurodon of Agassiz to be some other genus which he calls *Cimolichthys*, without characterizing it. This form is supposed to be established on palatine teeth, and if so, is well distinguished, as it will be seen below, that Saurocephalus has no teeth on the palatine bones. He also refers two other species of supposed *Saurocephalus* of Agassiz to a new genus called *Protosphyræna*, without characters. This I think rests on mandibular teeth of true *Saurocephali*.

SAUROCEPHALUS. Harlan.

Journ. Acad. Nat. Sci. Phila. III. 337. *Xiphactinus* Leidy Proc. Ac. Nat. Sci. Phil. 1870. 12.

SAUROCEPHALUS LANCIFORMIS. Harlan l. c.

Med. and Phys. Researches, 362. Leidy Trans. Amer. Philos. Soc. 1856. Tab. *Saurodon lanciformis*, Hays Trans. Amer. Philos. Soc. 1830, 476.

Established on a right superior maxillary bone from a locality near the Missouri river. It differs from that of the other species in having a very elongate superior suture with the premaxillary bone, and in the very short dental crowns, which are as wide as deep. The largest species; known from the jaw.

SAUROCEPHALUS PHLEBOTOMUS. Cope sp. nov.

Established on some vertebræ and portions of the cranium, the latter including the dentary, maxillary, part of the premaxillary, the palatine and vomerine bones, compressed into a mass by pressure, the separate pieces preserving nearly their normal relations. From the latter the following characters may be derived:

Palatine bones toothless; teeth of both maxillary and dentary, with compressed crowns, which are longer than wide at base, and closely placed, those of the dentary twice as large as those of the maxillary. Maxillary bone proximally deep; dentary shallower, the maxillary with elongate suture with the premaxillary behind.

The teeth are equilateral, without intermarginal groove or barb, and with smooth enamel surface, or only minutely striate under the microscope. A series of larger foramina extends along the alveolar margin of the maxillary and dentary bones, one foramen to each tooth. The alveolæ are confluent as they approach this margin.

There are three vertebræ, which present two pairs of deep longitudinal grooves, viz.: two on each side, two on the inferior, and two on the supe-

rior face of the bone; the last receives the basal articulation of the hæmapophyses. The centra are crushed, their measurements with those of the jaws are as follows:

	M
Length centrum	0.025
Long diameter (crushed)	.035
Short " "	.0175
Depth maxillary bone anteriorly	.031
Depth dentary " "	.015
Length crown inferior tooth	.006
Number " " " in .01m	3
" " superior " "	4.5
Length crown " " "	.0046

The vertebræ are about as large as those of a fully grown "drum fish," *Pogonias*.

From the yellow chalk of the upper Cretaceous of Kansas, found on the Solomon or Nepaholla River, Kansas, at a point 160 miles above its mouth, by Professor B. F. Mudge, Professor of Natural Science in the State Agricultural College of Kansas.

I append a description of some caudal vertebræ of a species probably different from the *S. phlebotomus*. It is indicated by three consecutive caudal vertebræ which resemble those of *S. prognathus* and *S. thaumas*, but which differ also considerably from both; the several arches and spines are of very great width: in *S. thaumas* they are narrow, and in *S. prognathus*, as wide, but here their width exceeds the depth and equals the length of the centrum. As in the other caudals, the lateral grooves are wanting and the inferior pair remain separated by a lamina. The neural suture is very distinct, and not two angled as in *S. prognathus*, but with a median decurvature and rise anteriorly. The neural spines are twice as wide as deep and lie on each other. The third vertebra is shorter than the others and contracted distally; it is probably the penultimate of the series; neural canal minute. Surface striate ridged.

Measurements.	*M.*
Length centrum anterior vertebra	0.021
Depth " (at middle) anterior vertebra	.015
Width neural arch at base spine	.010
Depth spine	.0072
Length third vertebra	.0135
Width neural arch	.014
" " spine	.0176

From a point twenty miles east of Fort Wallace, Kansas. Professor Mudge's collection.

In this species the vertebræ in question are longer in proportion to their other dimensions than in those described, besides carrying wider neural arches and spines.

SAUROCEPHALUS PROGNATHUS. Cope *sp. nov.*

This species is represented by a premaxillary and attached proximal portion of the maxillary bones of the right side, and by a large number of vertebræ and other bones. These portions were associated in the collections placed in my hands by Prof. Mudge, and relate to each other in size, as do those of the preceding species and the *Ichthyodectes ctenodon*.

The premaxillary is characterized by its great depth as compared with its length, and by the shortness of its union with the maxillary. The palatine condyle of the maxillary reaches a point above the middle of the alveolar margin of the premaxillary. The latter contains alveolæ of seven teeth, the anterior of which only presents a perfect crown. This is still more elongate than the crown of the teeth of *S. phlebotomus*. It is compressed, equilateral, smooth, and acute. Its direction is even more obliquely forward than the anterior outline of the bone, which itself makes an angle of 50° with the alveolar border.

The vertebræ consist of cervicals, dorsals, and caudals, to the number of about sixty, most of which are supposed to have been derived from the same animal. The groves are as in *S. phlebotomus*, there being two below, two on each side, and two above. The latter receives the bases of the neurapophyses, which are in many cases preserved. The inferior pair of grooves becomes more widely separated as we approach the cervical series, leaving an inferior plane, which is longitudinally striate grooved. This plane widens till the grooves bounding it disappear. The inferior lateral groove becomes widened into a pit which some of the specimens show to have been occupied by a plug-like parapophysis, as in *Elops*, etc., or a rib-head of similar form. The neurapophysial articular grooves become pits anteriorly, and these only of all the grooves, remain on the anterior two vertebra in the collection. Some of the posterior caudals preserve large portions of the neural arches and spines. They form an oblique zigzag suture with the body, consisting of two right angles, one projecting upward anteriorly another downward behind. The neural spines are very wide and massive and in close contact antero-posteriorly; these probably support the caudal fin. They are deeply and elegantly grooved from the basis upwards. The centra exhibit no lateral grooves.

An unsymmetrical fin ray accompanied these remains, and from its mineralization, color, size, and sculpture, probably belongs to them. The anterior margin is thinned, and with obtuse denticulations, the posterior truncate. The section is lenticular, with a deep rabbet on one side of the posterior edge; section at the base, apex circular lost. The sculpture consists of fine longitudinal raised striæ, which bifurcate and send numerous similar ridges to the teeth of the anterior margin. It is probably a spine of a pectoral fin. It is identical in form and sculpture with that recently described by Leidy as *Xiphactinus audax*, but differs in specific details.

	M
Long diameter of spine	0.0245
Basal " "	.019
Length, two cervicals (not distorted)	.033
Diameter of the anterior	.021
Length of a dorsal	.016
" " caudal	.014
Width neural spine of caudal, at base	.012
Length alveolar margin premaxillary	.022
" anterior " "	.02
Depth from condyle of maxillary	.026
Length crown premaxillary tooth	.0042
Diameter " " "	.002

A fragment of a large flat bone exhibits very delicate radiating grooves which are marked by spaced impressed dots.

From the upper Cretaceous of Kansas, six miles south of the town of Sheridan. Prof. B. F. Mudge. This species was about two thirds the size of the species last described.

SAUROCEPHALUS AUDAX. Leidy, sp.

Xiphactinus audax. Leidy. Proc. A. N. Sci. Phil. 1870, 12.

Established on a pectoral spine, supposed by Leidy to be that of a Siluroid. According to the description, it does not differ from that of *S. prognathus* in more than specific characters. Thus the anterior margin is weakly serrate in the latter, a feature not described by Leidy in the former. In *S. audax* the posterior portions of both sides are said to be grooved, in that part of the spine of *S. prognathus* preserved, one surface only exhibits the groove in question, one of whose edges is obliquely ridged, as in *S. audax*. From Kansas; museum Smithonian.

SAUROCEPHALUS THAUMAS. Cope sp. nov.

This is larger than any of the species here described. It is represented by wholes or parts of from seventy to eighty vertebræ, with numerous neural and hæmal spines and fin radii, and perhaps some ribs. There are no teeth nor cranial fragments. The bulk of the vertebræ is double that of those of *S. phlebotomus*, and appropriate to an animal of the size of the *S. lanciformis*. It may be ultimately found to be identical with that species; but there is no evidence conclusive of such a view at present in my possession.

The vertebræ present the usual two inferior, two lateral, and two superior grooves—the last for the neural arch. There are no cervical vertebræ, for these characters show them all to be dorsals and caudals. The suture for the neurapophyses forms a regular angulate convexity projecting downwards. The arch is not closed above anteriorly, and is expanded laterally, while the spine is directed very obliquely backwards. The concavities of the articular extremities are equal in the dorsals; but in the caudals one surface is much more deeply concave than the other, one being funnel-shaped, and the other nearly plane in a few.

A number of consecutive vertebræ are preserved, which represent the posterior portion of the caudal series. One of these is fortunately the very extremity, and they demonstrate the tail to have been vertebrated or heterocercal, after the manner of Amia. On the anterior series of three the lateral grooves have disappeared from the centra; the neural canal is very small, and the spines are very massive and curved backwards, but much less than in the more posterior parts of the column; they are flattened, wider than deep, and in close contact with each other. The anterior of the three, on the other hand, presents a narrowed edge forwards. The hæmapophyses are thin, and suturally united by a flat gomphosis. The terminal series embraces six vertebræ, which have a minute or obsolete neural canal, but hæmal canal distinct, but apparently interrupted. The hæmal arches are united to the centra by a rather smooth suture.

The general direction of these vertebræ forms a light upward curve. The hæmal spines are flat and laminar, and their margins in contact; they decrease in width and length to the end of the series. The neural spine lies obliquely backwards, and has a narrowed anterior ridge, but stout shaft.

The anterior hæmal spine in place exhibits a subglobular base, like an articulation, and its shaft is wider than those posterior to it. A subtriangular flat bone, with neck and subglobular extremity, applies very well to a concavity between the anterior pair of pleurapophyses, but does not in that position preserve contact with the anterior margin of the second spine. One margin of the enigmatical bone is thin and divergent; the other expanded laterally and straight. The latter gives off a transverse prominence like half a globular knob before reaching the extremity. Just within the latter are two large foramina, which are connected with the extremity by a groove on each side, which meet in a notch where the thin edge passes into the knob.

Both sides of the neural and hæmal spines are concealed in this species and in the *S. prognathus* by numerous parallel osseous rods, which are somewhat angulate in section. They lie along the centra of the anterior series of caudal vertebræ, but are not to be found on vertebræ of any other part of the column. Numerous loose and fragmentary rods of the same character accompany the loose and attached caudal vertebræ, and all of them, according to Prof. Mudge, belong to the "posterior swimming organ" of this animal. There is also a collection of these rods from the anterior region of the body, which Prof. Mudge thought occupied the position of an anterior limb. They do not any of them present a segmentation such as would be exhibited by the cartilaginous radii of caudal and pectoral fins, and their nature might have remained doubtful but for the explanation furnished by the anterior compound ray or spine of the posterior, probably caudal fin. This ray, as in the case of the pectoral spine and first anal rays of some existing Siluroid and Loricariid fishes, is composed of a number of parallel rods closely united. These

are in their distal portions remarkably and beautifully segmented, of which a very simple form has been figured by Kner, as existing in the pectoral spine of the Siluroid genus, *Pangasius*. This segmentation becomes more obscure proximally, and finally disappears altogether, leaving the spine and rods homogeneous. This portion of them is quite identical with the rods found in the positions of fins already described, and I therefore regard these as fin radii of the attenuated form presented by cartilaginous rays of most fishes, but ossified sufficiently to destroy the segmentation. They are thus in the condition of the anterior rays of the dorsal fin of some of the large Catostomidæ, where they are proximally homogeneous and bony, distally segmented and cartilaginous. This is an important character when found in pectoral and caudal fins, and such as I have not found described. It adds another feature to the definition of this group.

The segmentation above alluded to presents the following characters. The spine consists of four principal parallel rods, of which the external on each side thins, the one to an obtuse, the other to a thin edge. The more obtuse edge presents a groove on one side, which is occupied by a very slender rod, and a shallow rabbet along the flat edge is occupied by a slender flat rod. Of the four principal rods the two median are the most slender, and the flat marginal the widest. Of the two median, that next the last is the wider. The stout marginal, or probably anterior rod, is segmented en chevron, the angle directed forwards and lying near the free margin. The suture of the segments is entirely straight, except when returning it approaches the margin, where it suddenly turns to the margin at right angles to it. The next rod is segmented without chevron obliquely backwards and inwards; where it leaves and reaches the margins, it is at right angles to them, and the margin projects obtusely at those points. Between them the suture is very irregular and jagged, sending processes forwards and backwards. The segmentation of the next rod is similar, but more regularly serrate; distally it becomes as irregular as in the last. The transverse marginal termini of the sutures are serrate in both. The inner and widest rod presents a still more regularly serrate suture, with the truncate extremities; but, owing to the width of the rod, the near approximation of the sutures continues for a longer distance. When broken, the suture appears step-like,

This remarkably beautiful segmentation is paralleled remotely, as has been stated, by some Siluroids. Much more like the recent type are the segmented rays of the carboniferous genus, Edestus of Leidy, regarded variously by authors as a jaw or a ray; but now generally regarded as a ray.

Measurements.	*M.*
Length fragment of (?)caudal spine	0.25
Width " at proximal fracture	.06
Greatest thickness " "	.013
Width posterior rod " "	.0245
Length of six distal caudal vertebræ	.10

	M.
Width hæmal spine of second of series	.024
Vertical diameter centrum first "	.025
Length of neural spine and centrum of anterior caudal	.108
Transverse diameter of neural spine " " at base	.0235
Antero-post. diam. four anterior caudal neural spines in contact	.069
Length centrum of a dorsal	.04
Vertical diameter " "	.0615
Transverse " " " (crushed)	.041

These remains were found in place by Prof. B. F. Mudge: he states that their extent was eight feet. As they embrace no cervical vertebræ nor portions of cranium, two feet are probably to be added, giving a total of near ten feet for the length of this fish. It was discovered at a point on the bank of the Solomon's or Nepaholla river, in Kansas, 160 miles from its point of junction with the Kansas river.

SAURODON Hays.

Transac. Amer. Philosoph. Society, 1830, 476.

SAURODON LEANUS, Hays.

Loc. cit. Tab. xvi. Leidy Trans. Am. Philos. Soc. 1856.
From the cretaceous green sand of New Jersey.

ICHTHYODECTES. Cope, *gen. nov.*

In this genus the teeth are subcylindric and slender, without cutting edges. The inner margins of the maxillary and dentary bone exhibit no dental foramina, which are in *Saurocephalus* and *Saurodon*, of large size.

ICHTHYODECTES CTENODON. Cope, *sp. nov.*

This species is established on one complete maxillary bone, and three-fourths of the other, a large part of the dentary bone, with the entire dental series; numerous portions of cranial bones, with thirteen vertebræ. These, according to Prof. Mudge, were found together, and to all appearance belong to the same animal.

The dental characters differ from those of Saurocephalus, as above pointed out, and in this species more than in *S. leanus*. The crowns of the teeth are more exserted and slender. The inner face of the crown is more convex than the outer; but there is no angle separating the two aspects. The apex is moderately acute, and directed a little inwards, owing to a slight convexity of the external face. Enamel smooth. The alveoli are very close together, and are probably only separated in their deeper portions. There are forty-two teeth and alveoli in the maxillary bone. The palatine condyle is low, and its anterior border falls opposite to the last tooth, or the indented surface which was occupied by the premaxillary bone. The more proximal part of the maxillary curves inwards and backwards behind the position of the premaxillary more than in *S. prognathus*. The maxillary is a rather thin and narrow bone, with a

broad obtuse and thinned extremity. Its superior margin is marked with one or more acute ridges, which look as though it had a contact with a large preorbital bone. Two fractured bones with an elongate reniform condyle on a wide peduncle, look like the articular extremity of an operculum, which view is confirmed by their application to some flat, coarsely rugose bones which resemble parts of the latter.

The dentary bone is remarkable for its straightness and laminar character, and for the depth of the symphysis. The length of the latter is preserved, while posteriorly to it the lower margin of the dentary is broken away. The alveolar margin is slightly concave, and unites with the symphyseal at an angle of 65°. There are twenty-seven teeth and alveolæ, which grow a little larger to the posterior extremity of the series; anteriorly the alveoli are confluent externally, but posteriorly the septa are frequently complete, though thin. In neither this bone nor the maxillary are to be found the foramina along the bases of the teeth, characteristic of *Saurocephalus* or *Saurodon leanus*, as pointed out by Harlan and Hays. The vertebræ form a series of 13.4 inches in length, embracing thirteen caudals. This is indicated by the close approximation of the inferior pits and inserted pleurapophyses, and absence of lateral grooves. There are important differences from what has been described as characteristic of *Saurocephalus*. The neural arches, whose bases only are preserved, are much lighter and narrower than in it, and its sutural union with the centrum is less distinct. Their bases issue from pits; but their anterior portions appear in some cases at least to be co-ossified. They exhibit a longitudinal rib near one side. There are no heavy neural spines preserved. The sides of the centra are longitudinally rugose striate; inferiorly they are rugose with exostoses.

Measurements.	*M.*
Length maxillary bone	0.158
Depth at condyle	.031
" " extremity	.023
Length crown of a tooth	.0061
Diameter crown at base	.0038
Length alveolar border of dentary	.106
Depth symphysis " "	.047
Length opercular condyle	.018
Length centrum anterior caudal	.024
Width " (crushed)	.0278
Depth " "	.047

Specimens from six miles south of Sheridan, Kansas, on the north fork of the Smoky Hill river near its mouth.

General Considerations.

There have been described above, remains of three species, which include jaws with teeth, and associated vertebræ. In two of these cases the jaws and teeth were found together; in the third they came in the

same small box without special indication of locality; but the vertebræ are of precisely the same size sculpture, mineralization, and color as a large series whose locality is exactly known, to which they probably belong. Moreover, the jaws and vertebræ bear the same relation of size to each other in all three series. These facts render it highly probable that the remains are in each case rightly referred to the same animal. That no mixture has occurred is also probable from the fact that the large and small series (Ichthyodectes and S. prognathus) came from the same locality (Sheridan), while the species of intermediate size was discovered 160 miles from the mouth of the Solomon river, a long distance off. The pectoral spine, accompanying and belonging to the S. prognathus, I have shown to be the same as the Xiphactinus of Leidy, but probably not of the species *X. audax*.

The fourth series described above as *S. thaumas* exhibits precisely the vertebral characters of the two other species of Saurocephalus, and I cannot resist the evidence that it belongs to that genus or the same family. Its remains pertain to one animal, as asserted by Prof. Mudge, and their color and condition, coated with a chalky deposit of a ferruginous yellow color, lends great probability to the statement, to say nothing of more important reasons. No remains of pectoral spine are preserved; but instead, the remarkable segmented ray described. This comes from the posterior region of the vertebral column, and is, I believe, an anal spine, or the adjacent rays or compound ray forming the margin of the caudal fin. This finds support in the analogous structures already mentioned as occurring among Siluroids, etc., and the resemblance of the pectoral spine to the same weapon of the same group adds to the probability of the correctness of this conclusion.

These remarks are made because Prof. Agassiz, in the Poissons Fossiles, has referred several spines to the Cestraciont genus, Ptychodus, which are very similar in character to that described above as the anal or caudal support of Saurocephalus thaumas. These were derived from the upper cretaceous chalk of Kent, England, where Ptychodus teeth also occur. The Saurocephalus teeth, described by Prof. Agassiz in the same work, were, however, derived from the same chalk and the same locality, and, from what has preceded, I believe the segmented spines should be referred to the latter genus rather than to Ptychodus. This is the more probable, in view of the fact that Prof. Mudge did not procure a single Ptychodus tooth during his exploration.

ON THE FISHES OF A FRESH WATER TERTIARY IN IDAHO, DISCOVERED BY CAPT. CLARENCE KING.

By E. D. Cope.

The materials on which the present account is based were placed in my hands by the Smithsonian Institution. They were obtained by Capt. Clarence King, on his expedition sent out by the Government, for the geological exploration of the fortieth parallel west of the Mississippi river.

As will be seen, the fossils described are evidently from a fresh water basin, once a lake, which has, at a comparatively late period of geological time, been elevated and desiccated.

The species and genera are chiefly cyprinidæ, and from the number of the former, ten, important as throwing light on the character of the forms of that family at a time not long preceding the establishment in their present habitations of those now living. Remarks on these relations are deferred to the close of the descriptions.

CYPRINIDÆ.

Characters of the genera represented :—

A. Pharyngeal tooth series transverse to longer axis of the pharyngeal bones.

Pharyngeal teeth 0.4—?.? with compressed roots, and probably molar or masticatory crowns on an oblique basis, the highest extremity being inferior, the lowest superior. DIASTICHUS.

B. The pharyngeal tooth series very oblique to the longer axis of the pharyngeal bone.

Pharyngeal teeth 2.3(?4)—??, with round bases, and probably conic prehensile crowns ; no ala of the slender pharyngeal bones.

OLIGOBELUS.

C. The pharyngeal tooth series nearly in the longer axis of the pharyngeal bones.

Pharyngeal teeth 2.5—4.2 conic prehensile. SEMOTILUS.

Pharyngeal teeth 0.5—?.?, with short, compressed crowns and narrow, transverse masticatory face, and no prehensile hook ; bone alate.

ANCHYBOPSIS.

Pharyngeal teeth 0.4—4.0, or the outer row 1 or 2 rudimental ; crowns molar, broad, truncate, with enamelled grinding surface.

MYLOCYPRINUS.

DIASTICHUS Cope.

Genus novum.

DIASTICHUS MACRODON. Cope sp. nov.

Represented by three right pharyngeal bones, of which the distal extremities are lost. The proximal limb of the bone is long and flat, the extremity first dilated, then contracted coincidently with a transverse depression of the superior face, the end everted or expanded, with symphyseal surface within. There is no proper horizontal alar expanse, but rather an anterior one, the front face (inferior when on a plane surface), being a little oblique. Tooth series in the line of the axis of the superior limb of the pharyngeal bone, its base rising exteriorly and proximally. Outer face nearly vertical, grooved. The teeth are knocked off in all the specimens ; their bases are a broad, oval or parallelogram. The form of the crown is uncertain, but I suspect it to have been more or less truncate.

Measurements.	*M.*
Length proximal limb No. 1	0.027
Depth at base first tooth	.01
Width limb at middle	.008
Length limb No. 2	.017
Depth at first tooth	.0058
Length tooth series	.0135
Width third tooth basis	.005

These teeth indicate a species of about the size of the carp (*Cyprinus carpio*).

From Catharine's Creek, Idaho. Mus. no. 9792.

DIASTICHUS PARVIDENS. Cope sp. nov.

In this species the bases of the teeth are considerably smaller than in the last, and the proximal limb of the pharyngeal bone less depressed, and more cylindric. A section of the latter below the basis of the first tooth, is a triangle, the inner side a little shorter than the others. In the last species it is flat in that place.

	M.
Depth limb at first tooth	0·011
Width limb at middle tooth	.0065
Length tooth series	.014
Length basis third tooth	.0054

This species is represented by one pharyngeal bone of the right side, with the extremities incomplete, associated with many fragments of the cranium, etc. The size the same as that of D. macrodon.

No. 9782, Catharine's Creek, Idaho.

The peculiar arrangement of the tooth series in this genus, almost at right angles to that which is usual among Cyprinidæ. is not, so far as I know, shared by any recent genus of the family.

OLIGOBELUS. Cope.

Genus novum.

The direction of the dental series in this genus is intermediate between that seen in Diastichus, and the usual type. It resembles and exceeds the last described genus in the great elongation of the proximal limb of the pharyngeal bones, which are here considerably more curved. No bone of the genus preserves its distal end or its teeth complete. The bases of the teeth are round or oval, and not in close contact. It is scarcely likely that there were more than three in the outer row, though this is not certain. The proximal end of the series is abbreviated, as the first tooth of the index row is opposite its first, and the second opposite its second. The proximal end of the series is most elevated, but does not project beyond the lateral plane of the bone.

Should the outer series have embraced four teeth, a resemblance between the form of this bone and that of Ericymba and Exoglossum can be

traced. This genus will, however, be distinguished from those by the entire want of the lateral external ala common to these and other genera of Cyprinidæ. Two species are represented in Capt. King's collection.

OLIGOBELUS ARCIFERUS. Cope sp. nov.

Established on four right and one left pharyngeal bones, none of them with the distal extremity complete. The best preserved shows teeth 2. 3—, and there is no indication of space for a fourth, though its place of support is lost.

The proximal line is very strongly curved, and is long and slender. Its extremity is neither grooved nor recurved, but slender; its section would be a flat triangle, the inner face about equal to the outer. The size of the species equals that of *Diastichus macrodon*, the largest specimen exceeding any of the latter. It is probably the largest species obtained by Capt. King.

	M.
Length proximal limb No. 1	0.04
" " " " 2	.025
Depth near basis first tooth	.0065
Width " "	.0085
Length basis three outer teeth	.011
" " two inner "	.007

Nos. 9782, 9791, Catharine's Creek, Idaho.

OLIGOBELUS LAMINATUS. Cope sp. nov.

Established on a left pharyngeal bone which lacks the distal extremity. It differs from the other species of the genus in its broad, flat proximal limb of this bone. Its section is not triangular, but that of a plate with a thin outer edge.

	M.
Width limb just below first tooth	0.008
Depth " " " " "	.004

The expansion continues to near the proximal end.

No. 9791. Catharine's Creek, Idaho.

SEMOTILUS, RAFINESQUE.

I have referred to this existing North American genus two species of the present series, without being entirely certain that such reference will be finally adopted. It is based on the evidence of two pharyngeal bones of two species, one of the right and one of the left side, the former bearing four, the latter five teeth in the larger series. Should the series of the other bone of each prove to have the same number of teeth as the sides preserved, the species will be referable to two genera, the former 2.4–4.2 to Ceratichthys, the latter 2.5–5.2 to Gobio, both existing genera. To whichever of the three genera the species are referred, it remains to be one still in existence.

SEMOTILUS POSTICUS. Cope sp. nov.

Indicated by a left pharyngeal bone, of which the distal extremity has been broken away. The apices of the teeth of the exterior series are

broken away, those of the inner row are perfect. The bases of the former are cylindric, the latter are also cylindric, with conic crowns. Some fragments belonging to this or an allied species present conic proximal teeth, while specimens from other collections confirm the reference to Semotilus.

The expansion of the ala is very gradual, and projects anteriorly rather than outwards. Hence the outer face of the bone is one oblique plane from the bases of the teeth to the edge of the ala. The latter projects beyond the plane of the inner margin, so that the anterior face of the bone is oblique also. The external surface of the ala is cross-ribbed. The proximal limb of the bone is contracted, and slightly compressed near the teeth. Teeth 2.5—; the interspace between the inner pair, opposite the fourth of the outer series. The bases of the inner descend to the inner anterior margin of the base vertically.

Measurements.	*M.*
Length of tooth series	0.033
Depth at fourth tooth	.019
" first "	.011
Width " "	.0085
Length inner tooth	.011

This chub was larger than the common Eastern species, the S. rhotheus, the largest of the genus. The pharyngeal bone indicates a fish of five or six pounds weight. The gradual and slight expanse of the ala of this bone distinguishes the species from any of the existing ones. Named from the posterior direction of the teeth.

From St. Catharine's Creek, Idaho; obtained for Capt Clarence King by J. C. Schenk. Smithsonian, No. 1489.

SEMOTILUS BAIRDII. Cope.

Sp. nov.

This species differs from the last in the much less expansion of the external or alar margin of the pharyngeal bone. It has scarcely any alar prominence of the angle, which also projects so little beyond the inner margin as to render the anterior or perforated surface almost transverse. Distal end of the bone gently curved; proximal limb compressed near the teeth. Teeth 2.4—, those of the inner pair opposite the third and fourth of the outer series. Bases cylindric; crowns not preserved; outer face of the bone with numerous foramina penetrating it backwards.

Measurements.	*M.*
Length of tooth series	0.021
Depth at third tooth	.01
Width " "	.006
Depth at first "	.008

From the same locality and explorer as the last species. No. 1482.

This species is dedicated to Prof. Spencer F. Baird, to whom the author is under greater obligations than to any other man, in respect to his special pursuits.

ANCHYBOPSIS. Cope.

Genus novum.

This form, characterized above, is nearly related to several now existing in the rivers of the United States, so far as the pharyngeal teeth serve as an indication. It is well known that they are more significant than any other part of the skeleton among the Cyprinidæ. They are arranged in one series of five on the right side, which rises and stands on a prominent basis superiorly, as in various genera, as Stilbe, most Hybopses, etc. This prominence is due to the abrupt incurvature of the superior limb of the bone. The crowns of the teeth are compressed, the grinding face truncate a little obliquely, and with a slightly concave transverse worm surface. Proximal limb small.

In *Hybopsis* the teeth are 4–4, but in *Hemitremia* Cope, 5–4, and quite similar to those of this genus. In *Hemitremia*, however, the lateral line is incomplete, and coincidence in this point is necessary for the reference of the present form to that genus. Imperfection of the lateral line is not known among the larger forms of true Cyprinidæ on this continent, and may not have existed in this genus. The principal ground of separation from *Hemitremia* is found in the transversely compressed and very short crown of the teeth; in the latter they are elongate and subcylindric. *Anchybopsis* is a more typically herbivorous form, and probably had much convoluted intestines, while in *Hybopsis* they are of the short carnivorous type.

ANCHYBOPSIS LATUS. Cope.

Spec. nov.

The only species of the genus. The pharyngeal bone expands rather abruptly into a prominent ala, without angular outline, and which soon turns into the outline of the superior limb. Surface of ala with transverse grooves to margin. Sizes of teeth 4, 3, 2, 5, 1, the first smallest, and with obtuse, subconic crown. Section of proximal limb at base of last, a triangle with truncate apex directed outwards. Teeth directed inwards; nutritious foramina on front of bone numerous and large.

Measurements.	*M.*
Length tooth series	0.026
" third tooth	.011
Long diameter crown tooth	.0075
Width bone at third tooth (exterior)	.016
" " " (anterior)	.016
" " first tooth (exterior)	.006

MYLOCYPRINUS. Leidy.

Proceedings Academy Natural Sciences. Philadelphia, 1870, p. 70.

This genus, named by Leidy, as above, had been noticed by Dr. J. S. Newberry* as allied to Mylochilus, Agass. Leidy compares it to the carp and other Cyprinoids. Its affinities are apparently between Mylo-

* In Proceedings New York Lyceum Natural History, 1870. Copied into Nature, 1870, p. 385.

chilus and Cyprinus; though it has fewer teeth than either, its formula 4—4 or 2.4—4.2, being that of the majority of the existing American genera. According to Agassiz, the first-named displays 2.2.5—5.2.3 etc.; while in the latter they are 1.1.3—3.1.1, and have concentrically sulcate grinding surfaces. In the present genus, these surfaces are smooth, except where excavated by use. The inner series is represented by two rudimental teeth, which are often wanting.

In describing the pharyngeal bones which belong to this genus, Leidy commits the error of inverting them, calling the inferior extremity the superior, etc. The symphyseal articulation of the bones he then regards as designed for articulation with the cranium, a structure which, it is needless to observe, has no existence in this division of fishes.

Among the numerous specimens brought by Capt. King, I recognize at least three species, as follows:—

MYLOCYPRINUS ROBUSTUS. Leidy.

L. c.

Teeth rapidly diminishing in size upwards, the last with crown from one-fourth to one-sixth the area of that of the first, and standing on an elevated base which projects upwards. Alar margin expanding very gradually, its greatest expansion generally below opposite to the basis of the first tooth, and considerably contracted opposite to the last tooth. The superior limb short, flat, abruptly incurved.

Eleven specimens, of which six belong to the left side. They vary in the outline of the basis of the teeth; in most, it is quite straight, in others curved; and, as a consequence, in these the superior part does not form such a prominent buttress as in the first. A large species. Greatest length of longest bone, 0.046 M.

No. 9792, Catharine's Creek, Idaho.

A single right pharyngeal of large size may indicate another species. The tooth series is curved, and the first tooth unusually small. The principal peculiarity is seen in the superior limb, which is long, slender, and transverse, with a median contraction, and less flattening than in the other specimens. Locality the same.

MYLOCYPRINUS KINGII. Cope.

Spec. nov.

This is represented by a single right pharyngeal bone of large size, and is distinguished by peculiarity in the character of its teeth. These, instead of diminishing in size upwards, increase, so that the fourth tooth is larger than the first, instead of one-fifth the size as in *M. robustus*. The second and third are intermediate in proportions. The crowns are broad, transverse ovals. The proximal limb of the bone is short, and gradually expands into the ala, whose greatest width is opposite the second tooth. The superior limb is short, narrow, and incurved. A trace of basis for a small tooth of an inner series.

Measurements.	*M.*
Greatest length of bone	0.046
" " dental series	0.026
Transverse diameter first tooth	.008
" " third tooth	.009
" " fourth tooth	.008
Width bone at second tooth (exterior)	.017
" " " " (anterior)	.018
Length proximal limb	.02

From the same locality as the last. Dedicated to Capt. Clarence King, to whom science is indebted for the survey of the fortieth parallel, and the palaeontological discoveries incidental to it.

MYLOCYPRINUS LONGIDENS. Cope.

This third species of the genus is represented by one right pharyngeal bone bearing the upper three teeth. It is quite distinct from the species already named, in several points. The ala commences by an abrupt expansion opposite to the middle of the first tooth, instead of by a gradual widening of the proximal limb. Hence, in this species the latter is more slender than in the others. Next, the teeth are of nearly equal size, the transverse diameter of the three being about equal, though the last is rather flatter than the others. Thirdly, the teeth are more slender, the length of the shanks being much greater than the long diameters of the crowns; these measurements are nearly equal in the other species. Lastly, the type of the present species is scarcely half the size of the most numerous individuals of the *M. robustus* and *M. kingii*. The basis of the tooth series rises obliquely backwards, as in M. robustus, and within it are the bases of two small teeth of the inner row, better developed than in that species. The diameters of the second and third teeth are equal.

Measurements.	*M.*
Greatest length right pharyngeal	0.029
" " tooth series	.018
" " proximal limb	.012
Elevation second tooth	.007
Transverse diameter crown	.0048
Width bone at crown (exterior)	0.115
" " " (anterior)	.013

From Catharine's Creek, Idaho, No. 9192. Capt. King's Expedition. Collected by J. C. Schenk.

SALMONIDÆ.

RHABDOFARIO. Cope.

Genus novum.

Teeth on the maxillary and mandibular arches large, numerous; teeth on the vomer, glossohyal, and palatine bones, also well developed. Teeth with hollow crowns and plicate dentine, which is ribbed on the pulp cavity, and grooved externally. Muzzle and mandible sub-equal. Max-

illary bone much prolonged, sub-cylindric, but little compressed distally, bearing reduced teeth near its extremity. Preorbital bone short, suborbital narrow. Inferior basihyals as deep as long.

This genus is nearlly allied to Salmo. With no other portions of the animal than the cranial bones, the only difference I discover is in the form of the maxillary bones, which are subcylindric or rod-like, instead of flat or laminiform, as in Salmo. At the extremity, though flat, they are still narrow, and I do not find surface of attachment for the supernumerary bone of Salmo.

RHABDOFARIO LACUSTRIS. Cope.

Species nova.

This fish is represented by a large part of the cranium, including all anterior to the middle of the orbits above, to the metapterygoid medially, and to the posterior part of the dentary below. Both dentaries remain, but the premaxillary and maxillary of one side only are preserved. There are separate portions of the maxillary bone, of four other individuals, and mandibular and palatine of one. These indicate a salmon of the average size of the migratory marine species, *Salmo salar*.

The cranium has been compressed, but apparently not depressed, so that the plane of the muzzle from the frontal bones is perhaps nearly preserved. In its present condition the profile descends very gradually, and the muzzle has an acuminate form. The frontals are ornamented by numerous grooves which radiate anteriorly, and are more numerous medially. The premaxillaries are subvertical, or roof shaped, and their broad lateral face is prolonged well backwards—to opposite the fifth mandibular tooth. The distal part of the maxillary and the dentary are striate-grooved, the latter obliquely downwards. The extremities of the dentaries are rugose, and emarginate in profile. They are not produced or recurved at the symphysis, and the latter is not coössified in the specimen. The anterior extremity of the premaxillary is lost, but the remaining portion supports five teeth. There are seventeen on the part of the maxillary preserved, three in 0 M.01. There are 14–15 on the dentary, two in 0 M.01. The palatine, vomerine and the glossohyal teeth are a little smaller than the dentaries, and more as the maxillaries. All the teeth have swollen bases, with a plurodont attachment. The crowns are cylindric, acute, and on the lateral bones, incurved.

Measurements.	*M.*
Length of the tooth series of the dentary	0.092
Depth of symphysi	.018
Depth pterygoid and palatine at last mandibular tooth	.027
Depth premaxillary at middle	.018
Length crown of a mandibular tooth	.008
Width of half frontal bone at nares	.014
" suborbital	.0085

The preorbital region is occupied by a bone somewhat T-shaped, the vertical limb spatulate, directed downwards and forwards, with grooved margins. Suborbital with rough marginal face.

This specimen was found by J. C. Schenk for Capt. Clarence King, at Castle Creek, Idaho. No. 9790 Smithsonian Collections. The other specimens are from Catharine's Creek, Idaho; Nos. 9785—9786. A portion of a maxillary of one of these forms indicates a fish half as large again as the one above described.

General Observations.

The six genera of fishes above described, present interesting relations to existing ones. One of them, Semotilus, is recent, while three are closely allied to existing genera; viz.: Rhabdofario, Anchybopsis, and Oligobelus. Distichus and Mylocyprinus are less nearly related to living genera. The five representing the Cyprinidæ can be referred to the groups into which the existing members of the family fall; thus Semotilus and Oligobelus are carnivorous, and Anchybopsis and Mylocyprinus herbivorous and molluscivorous. Accompanying these fossils are three species of the recent genus Astacus, (A. subgrundialis, etc) which I describe in the Proceedings of the American Entomological Society for 1870.

The molluscs of this formation have already been described by F. B. Meek, and they, like the fishes, determine it to be lacustrine and fresh, as already stated by Prof. Newberry. The species are stated by Meek * to be distinct specifically, and in some cases generically, from all others hitherto described from the West. Leidy observes,† that Mammalian Remains received from Capt. King's expedition include portions of *Mastodon mirificus and Equus excelsus*, which indicate an age similar to that of the bad lands of the Niobrara, which Hayden calls Pliocene.

The remains described in this paper furnish few means of determining the age of the deposit. There is, however, a great probability of their being later than Miocene, and nothing to conflict with their determination as of Pliocene age.

It may be added that numerous portions of skeletons of fishes remain to be identfied, in Capt. King's collection

ON THE ADOCIDÆ.

BY E. D. COPE.

ADOCUS. Cope.

Proceed. Acad. Nat. Sci., Phila., 1868, 235. Proceed. Amer. Philos. Soc., 1870, 295; Transac. Am. Phil. Soc., 1869, 232.

Additional material enables me to add important characters to this genus, and to define its position with something like precision.

In the first place I find that it possesses a large intergular plate. This I have verified on A. beatus and A. syntheticus, sp. nov. Having also perfect xiphisternal bones of these two species, I can show that there is no sutural attachment for the pelvic bones. The coexistence of these two characters has been hitherto universal, and the present deviation from it is a point of much interest. Instead of sutural surfaces, there

* Proc. Acad. Nat. Sci., Phila., 1870, 56.

† l. c. 1870, 67.

is an obtuse ridge corresponding to the pubis, and a knob answering to the extremity of the ischium, both more prominent than is usual in genera of Emydidæ.

This exceptional combination of characters points to the propriety of separating Adocus as the type of a family equally distinct from the Emydidæ and the Hydraspididæ, to be called the Adocidæ.

'Further characters of the genus have been already pointed out in the later essays above quoted. They are: the free lobes of the plastron narrowed and shortened, furnishing extensive posterior and anterior entrances to the carapace. A series of intermarginal scuta on the bridge. Costal capitula reduced or wanting.

No recent or even tertiary form of the Testudinata has yet been discovered, which possesses the remarkable combination found in this genus, and I think it must be regarded as a generalized group, and as such of much interest to the student of palæontology.

The determination of the presence of the intergular plate in this genus enables me to isolate from it the *Baptemys* of Leidy, which is otherwise very similar. This being the case, there is reason to believe that the latter is a Tertiary genus, and not Cretaceous one, as I had before been inclined to suspect.

The species then are:

I. With mesosternum deeply received.

Plastron very thick.	A. PECTORALIS.
Plastron thin.	A. PRAVUS.

II. With transverse mesosternum.

a. Posterior lobe of plastron contracted, long as wide.

Plastron of medium thickness.	A. BEATUS.

aa. Posterior lobe broader than long, rounded.

Plastron thick, sparsely punctate.	A. SYNTHETICUS.
Plastron thin, closely punctate.	A. AGILIS.

ADOCUS SYNTHETICUS. Cope.

Spec. nov.

Established on a plastron which lacks the mesosternal, one episternal, and one hyposternal; also on a marginal bone from the bridge, two imperfect costal bones, proximally complete, and some smaller fragments.

The bones of the plastron present that oblique junction of element with element diagonally across the point of crossing of longitudinal and transverse sutures, as has been observed in all the species of the genus, except A. pectoralis. Thus the right hyposternal, besides the usual union with the left, presents a considerable suture for the left hyposternal, and a lesser one for the left xiphisternal. The median dermal suture does not coincide with the osseous behind the hyosternal bone; but it is considerably to the left of it, dividing the xiphisternal bones unequally. The osseous suture is irregular and undulating. The hypo-xiphisternal suture extends abruptly backwards near the margin of the plastron. This margin behind the groin is thinned rather abruptly, with a marginal

groove inside near the bridge, but it descends abruptly at the median xiphisternal suture behind. The anterior extremity of the plastron is rather broadly truncate, but little excavated, and with thick margin. The form of the mesosternum is easily made out, from the fact of the preservation of at least one of all its corresponding marginal sutures. Its antero-posterior length is at least .75 less than its transverse. It had no posterior median process or spine, as in many Emydes.

As regards the scuta, the femoro-anal suture is directed backwards outwardly; the abdominal scuta are the longest. The pectorals, instead of narrowing medially, as in most Cryptodira, widen interiorly, their common anterior apex being on the mesosternal bone. The gulars are much reduced by the large intergular; each forms a spherical triangle—the apex outwards, the suture with the humeral, concave. The intergular is marginal, behind as wide as before, and convex; each half .66 wide as long.

The plastron is everywhere quite thick medially, but less so than in the A. pectoralis. The superior surface of the xiphisternal bone presents a curved ridge in the position of the pubic scar of the Pleurodira, which is nearer the margin than either suture, and slightly curved backwards. A marked sublongitudinal depression is seen between it and the median suture. Near the latter, more than one-fourth its length from the margin, thus farther from the latter than in Taphrosphys sp., is a smooth, low knob corresponding to the ischium.

The posterior lobe of the plastron is broad and regularly rounded, resembling thus the A. agilis. In the latter the pelvic ridges are scarcely developed at all, and the bone is everywhere thinner.

The axillary margin within presents a strong ridge, which becomes elevated as it rises with the axillary internal buttress of the carapace. This ridge is much weaker in A. beatus and the other species. The external surface of the bones is studded with impressed dots, which are separated by intervals posteriorly, but on the episternal bone are confluent, leaving the surface rugose with small elevations. The sculpture differs from that of A. agilis in being minuter, less distinct, and not disposed in regular rows. The fragment of the bridge displays the axillary and part of the anterior intermarginal plate. The former extends considerably in front of exterior to the axillary notch; the latter can only be compared with the same in A. pectoralis, as it is not preserved in the A. agilis. It is relatively broader than in the former, and with less oblique anterior border; the exterior angle which joins the suture of the marginal is situated more anteriorly. A considerable extent of a marginal scutum of the bridge is preserved. Its transverse exceeds its longitudinal extent, and its anterior margin is regularly convex.

One costal presents a rudiment of capitulum; the other none.

	M.
Length of plastron	0.484
Width " to first marginal of bridge	0.33
Width posterior lobe at groin	0.23

	M.
Length posterior lobe from groin	0.155
" median suture episternal	0.038
" mesosternal	0.07
Width "	0.095
Thickness hyosternal behind medially	0.015
" hyposternal "	0.020
Width intergular scute	0.053
Length gular (antero-posterior)	0.003
" caudal sentum	0.083
Width costal proximally No. 1	0.038
" " " No. 2	0.055

This fine species was discovered by my friend, J. C. Voorhees, in the upper bed of cretaceous green sand, at Barnesboro, N. J. This gentleman is well known as the preserver of the unique and invaluable fossil of the *Lælaps aquilunguis*.

ZYGORAMMA. Cope.

Genus novum familiæ? Adocidarum.

Marginal bones of the carapace united wi h the costals by both suture and gomphosis: the suture existing on the free marginals, as well as on those of the bridge, the gomphosis inferior to and more distal than the suture. Hyposternals uniting with the marginals only, by gomphosis. Dermal scuta distinct.

This genus is represented by a single species, which has left us but few remains. These do not furnish positive indications for its reference to the Cryptodire or Pleurodire divisions. The mode of union of the plastron and carapace is, however, much more likely that of the Emydes and Adoci; and I therefore suspect it to be Cryptodire. The character of its sculpture is also that of the last named genus, rather than of Taphrosphys.

Zygoramma striatula. Cope.

Sp. nov.

Represented by five marginal bones, three incomplete costals, and both hyposternals with their external margins broken off. These bones indicate a species of light and elegant construction. The hyposternals are thin, and of nearly equal thickness transversely. Their sutures are very coarse, and present but little irregularity at an intersection, in those of opposite corners, excluding the other pair from contact, as is usual in Adocus sp. The gomphosis of the hyposternal rises very obliquely. The posterior lobe of the plastron has an acute margin, which continues as an angle beyond the inguinal notch anteriorly. The fracture of the surface prevents my ascertaining the existence of a series of intermarginal scuta. The suture between the femoral and abdominal scuta divides the hyposternals about equally.

The marginals at and near the bridge are nearly twice as deep as long. The posterior of the bridge is gently convex, with the margin a little

recurved. The two following (posterior to the bridge), are nearly plane without recurved margin, which is slightly prominent at the point of contact of the dermal suture of the marginal scuta. The posterior marginal bones are concave superiorly, the margin not otherwise recurved. These marginals are, as usual, thickened underneath beyond the proximal suture; and into this the free end of the rib is inserted into a deep, oval pit. On the terminal marginals of the bridge the pit is more distal, and round. The free end of the rib springs from the costal bone at the suture, and its length varies from an inch to a half an inch. The pit for the hyposternal is chiefly in the last bridge marginal, partly in the first free marginal. It extends along the edge of the inner thickening, as the latter descends on the bridge.

The sculpture of the costal bones consists of longitudinal shallow grooves, which are more or less confluent (they are thus transverse to the costal axis). On the marginals, the same ornamentation is varied by the grooves being impressed punctate; behind the dermal suture, they are directed slightly upwards; anterior to it, they rise more obliquely. On the posterior marginals, they are still more oblique. The sculpture of the plastron is obliterated.

	M.
Inguinal width of plastron	0.124
Length hyposternal	.08
First free posterior marginal width	.067
" " " length	.046
" " " greatest thickness	.011
Corresponding costal, width	.037
" " thickness	.0045

From the upper bed of cretaceous green sand, Burlington County, New Jersey. Discovered by my friend, Judson C. Gaskill.

The size of this species is about that of a snapping-tortoise (Chelydra).

HOMOROPHUS. Cope.

Genus novum Adocidarum.

Costal capitula wanting or rudimental. Vertebral bones of the carapace co-ossified with the costals, sometimes, outlined on the inner surface, where they appear to be lanceolate in form. The original costo-vertebral suture, when traceable, very oblique; the superior face of the vertebral much wider than the inferior. Vertebral scuta often narrower than the supposed outline of the vertebral bones; on the posterior portions of the carapace wanting.

This genus is evidently allied to *Adocus* by the character of its costal capitula, but not having the episternal nor xiphisternal bones, nor the outer part of the median sternals, I cannot add other points of resemblance or difference. The coössification of carapacial elements is without parallel in the order, and the form of the vertebral bones prior to this union, probably at an early period of life, was very peculiar. Their

transverse section would be that of a broad wedge with slightly truncate inferior apex. The neural spine lamina is attached in a strong inferior groove of these pieces. The groove becomes wide and shallow posteriorly. At the extremity of the vertebral series there are two isolated rugose elevations, perhaps for the last neural spines. On each side of the last a shallow concavity marks the point of contact of the ilium.

HOMOROPHUS INSUETUS. Cope.

Species nova.

The mesosternal bone is joined by an openly concave sutural margin of the hyosternals on the lower surface. On the superior face the sutural margins are straight, projecting further posteriorly and forming an obtuse angle. The pectoro-abdominal dermal suture crosses the hyosternals near their middle; the abdomino-femoral, which is rather obscure, at the posterior third.

The superficial sculpture of carapace and plastron is destroyed. The inferior surface of the costal, displays a marked concavity exterior to the position of the rudimental costal capitulum. The curvature of the costals is well marked. When separated from each other, a fine sutural face forms the inferior third of the thickness, the superior two-thirds being fracture only. There are three vertebral dermal scuta more or less completely preserved. The outline is coffin-shaped anteriorly; in one the lateral margins are convex, in another concave, and then expanding again posteriorly, the whole being fiddle shaped (panduratus). The two posterior costal scuta meet on the middle line, and the last pair embraces a pygal which is elliptic in front.

The shell is every where stout, and excessively thick; neither hypo nor hyosternals being thickened medially. The left hyosternal joins the right hyposternal at the intersection of the sutures.

	M.
Length hyosternal on median suture	0.095
" hyposternal " "	.105
Thickness " " "	.015
" median costal proximally	.011
" anterior vertebral	.014
Length " "	.06
Width do. anteriorly	.0285
" " posteriorly	.91
" anter. vertebral scute anteriorly	.035
Length " " " "	.06

The free edge of the hyposternal is thinned to an edge rather abruptly. The last distinct vertebral scutum is wider than the others, a costal suture going off near its posterior margin.

The slight enclosure of the mesosternal bone gives the plastron a resemblance to those of *Adocus syntheticus*, *A. beatus*, and *A. agilis*. The last is much thinner; the second differs entirely in the characters of the vertebral scuta, &c. It is nearer the A. syntheticus, but besides the

generic differences in the carapace, the abdomino-femoral dermal suture crosses at the posterior third of the hyposternal bones, instead of at their middle, as in the Adocus syntheticus.

This species, like the last, was found in the upper bed of the Cretaceous green sand, at the works of the Pemberton Marl Company, New Jersey, by Judson C. Gaskill, the director. The name of this gentleman frequently occurs in my contributions to the paleontology of the Cretaceous, and I take the present opportunity of expressing my indebtedness for the constant liberality with which he has aided in the advance of the science. Without his attention to and enlightened interest in the subject, many interesting points in the history of the life of the Cretaceous periods would not have come to light. Those desirous of seeing one of the fine sections of the middle marl bed to be found in the state, will be repaid by a visit to the opening made under the direction of Mr. Gaskill.

EIGHTH CONTRIBUTION TO THE HERPETOLOGY OF TROPICAL AMERICA.

Read before the A. P. S., September 16, 1870.

By E. D. Cope.

The materials whose examination has furnished the following additions to zoological science, consist of four collections. These are, first: one from Pebas, Equador, on the Amazon, from John Hauxwell; second, that made by Prof. Agassiz, of the Thayer Expedition to Brazil; third, a collection from Turk's Island, West Indies, obtained from Prof. Adrian J. Ebell; and fourthly, a small collection made by Dr. R. E. van Rijgersma at St. Eustatia.

The first collection furnished the following species in addition to those already determined by me from the same locality, in two papers, viz: in Proceedings Ac. Nat. Sciences 1868, 96, and do. of the American Philosophical Society 1869, 156.

OPHIDIA.

Erythrolamprus æsculapii.
Lygophis nicagus, Cope, Proc. Ac. Nat. Sci. Phil. 1868, p. 132.
Oxyrhopus petolarius, var. G. (Günther)
Oxyrhopus plumbeus. L.
Xenodon angustirostris? Peters.
Hydrops callostictus, Günth., Ann. Mag. N. H. tab.
Helicops chrysostictus, Cope, (*Tachynectes*) Pr. A. N. S. Phil. 1862, 71.
Thrasops ahaetulla. L.
Rhinobothryum lentiginosum Scopoli.

LACERTILIA.

Anolis nasicus.
Polychrus marmoratus.
Doryphorus castor, Cope, sp. nov.
Hyperanodon ochrocollaris Spix.

BATRACHIA.

Hyla polytaenia, Cope, Proceed. Am. Philos. Soc. 1869, 164.

Hyla leucophyllata Beireis var. *triangulum* Gthr ; see Cope, l. c. p. 156.

Hypsiboas* punctatus Daud. Dum. Bibr. etc. Of a pink color in the yellow dots, in life.

Hypsiboas hypselops, Cope, sp. nov.

Hypsiboas lanciformis, Cope, sp. nov.

Scytopis (Dryomelictes) aurantiacus Dandin.

Pithecopus tomopternus, Cope, Proc. Acad. Nat. Sci. 1868, 112.

Pithecopus tarsius, Cope, l. c, 113.

Phyllomedsa scleroderma, Cope, l. c. 112 ; very large examples.

Coecilia.

HYPSIBOAS HYPSELOPS, Cope, *sp. nov.*

Of the group of H. crepitans Wied. The fingers are not webbed beyond the basis of the proximal phalanges, except perhaps on the external one. When the arm is extended, they reach a trifle beyond the groin. The hind limb extended brings the heel a little beyond the muzzle. The general form is slender ; the head broad and flat. The canthus rostralis is distinct, but very concave, and the rostrals prominent on a narrow truncate muzzle. The outline of the head is rather acuminate to the apex, intermediate in form between H. crepitans and H. boans. The eyes are very large and prominent, entering only 1.5 times in the rather elongate muzzle. The tympanum is small, one-third the orbit in diameter and one-half the interorbital width. Dermal free, margins none ; a slightly prominent fold on the elbow and spur on the heel, only a prominence on the other. Skin above smooth. Digital dilatations hardly .50 diameter of tympanic membrane.

Color, above bright chestnut brown, below pale violet ; no marks on the head or back. Upper arm of the same color, as is a band on superior face femur. Front and back of femur, sides .66 of distance to axilla, and intero-anterior face of tarsus and metatarsus, with vertical black bands. They are very distinct and wider on the front than the back of the femur ; the latter connect faintly above. Three or four faint cross bars on tibia above. Two black spots on back of brachium, and one or two on front of antebrachium.

Vomerine tooth series arched as in other species, tongue broad. Ostia pharyngea very small, one-fourth choanæ.

Length of head and body, 0m. 056 ; of hind limb, .091m ; of foot .038m; of tarsus .02 ; width of jaws below tympanum .02 ; length from same point (axial) .016.

The acuminate muzzle, larger eye, and anterior femoral bars, distinguish this from the H. crepitans. The same characters separate it from H. indris, with the additional ones of smaller tympanum and larger limbs.

From Pebas Equador, Jno. Hauxwell's collections.

*The name of the allied genus *Cinclidium*, Journ. Ac. N. Sci. 1867, 200, having been used before for a valid genus of plants, I propose to change it to Cincloscopus.

Hypsiboas indris, Cope.

Journ. Ac Nat. Sci. Phila. 1867, 201.

This species with the small feet and dilations of the H. crepitans, exhibits the broader head of the H. leprieurii type, with the vomerine series incurved anteriorly as in the majority of species of the genus. The spur on the thumb is smaller than in any species of the genus in the single specimen at our disposal, and the antebrachial and tarsal folds are distinct. Gular region smooth. There is a cross band between the eyes darker than the ground color; the femora are crossed above by broad, rather indistinct cross-bands very different from those on the posterior face, and similar to those on the tibia; in H. circumdatus, the same narrow black bands are continued from behind to the front of the tarsus, without interruption. Indistinct brown markings on the labial regions.

The shorter hind limbs, distinguish this species from the H. crepitans.

Habitat Surinam *Hering*. Mus. Academy Nat. Science, Philada.

Hypsiboas circumdatus, Cope.

Journ. Ac. Nat. Sci. Philada. 1867, 201.

Breadth of cranium at tympanum equal from end muzzle to opposite middle line of humerus; canthus rostralis little marked, concave. Sacral width twice in coccyx, three times from articulation of latter to opposite outher canthus of eyes. Tympanum two-thirds occular opening. Vomerine series width divergent, oblique, scarcely curved; palmation of band to middle antepenultimate of foot to origin of penultimate phalange of longest toe. Thumb an incurved unusually elongate osseous spur. Areolations wanting on the breast, upper and under lip indistinctly yellow margined. Femoral bands ten, blackish, very narrow and nearly surrounding the leg: seven broader cross the tibia.

This species differs from the H. palmata in its much shorter palmation, smaller size and different coloration; from the H. crepitans, in its stouter form, and much stouter feet and hands, and different coloration, comparative measurements given under the head of the latter exhibit this.

Habitat, Brazil, no. Mus. Compar. Zoology, one specimen.

The thumb-spur of this species is more striking than in any other of the genus.

	H. crepitans		H. circumdatus.	
	In	line	In	line
End muzzle to end coccyx	2	3	2	8
do do origin coccyx	1	5.75	1	9.75
do do poster. marg. tympanum		8.5		10
Width cranium at latter point		9.5		11.25
From muzzle to opps't outer canthus eyes		3		4
Anterior extremity	1	5.5	1	9.25
Carpus and longest digit		8.5		9.25
Posterior extremity	3	10.25	4	9.25
Tibia	1	2	1	5
Tarsus		8.5		10
Metatarsus and longest digit		10		13.25

The three species just described have the palmation of the toes extend-

ing to the base of the third phalange. In H. fasciatus Gthr. the web only extends to the base of the second.

HYPSIBOAS LANCIFORMIS, Cope. *Sp. nov.*

This is a large species of the H. boans group. It is characterized by its elongate acuminate head, with nearly straight, sharp canthus rostralis and vertical concave loreal region. Eyes prominent, large, their diameter twice in length of muzzle, equal to interorbital width, and not quite twice the diameter of the membranum tympani. A prominent dermal fold proceeds from it, overhanging the tympanum, to near the middle of the side; its margin is roughly glandular. No dermal margins nor spurs on the limbs. Fingers not webbed beyond the metacarpals; reaching when the limb is extended, to the hind face of the femur. Hind limbs very long, the muzzle making the second third of the extended tibia. Web extending to the end of the second phalange of the fourth toe of the foot. Ostia pharyngea small, one-fifth of the very large choanæ. Tongue oval, longer than wide. Vomerine teeth forming two angulate series, the two short limbs of the angle uniting on the median line, without interruption. Finger-dilatations large, not quite half the tympanum in diameter.

Color, bright chestnut brown above and on the sides, shading into smoky in the groin. The whole under surface a dark maroon. A black band passes from the end of the muzzle, as wide as the loreal region, through the eye and tympanum to along the axilla. Upper lip with a broad yellow band, interrupted on the premaxillary apex, and continued a short distance in front of the canthus oris on the mandible. No cross bars or bands on the sides or limbs; femur behind and before, smoky maroon. A few irregular scattered dots on the back, and an indistinct series of fourteen brown cross bands on the back and head. Dilatations of the three inner fingers yellow above. Length, head and body, 0m.087; of hind limb .158m.; of foot .067; of tarsus .033. Width of sacrum .016; of head below posterior margin of tympana .028m.; length (axial) from same point .027. Length of fore limb .05m.

This peculiar species resembles externally, a Polypedates. It need only be compared to the Hypsiboas boans D. B. and H. oxyrhina R. and L. From the former it differs in the entire absence of black or other colored bars on the femora and flanks, in the darker coloration of the under surfaces, etc., and the more elongate, lance-shaped head. Its thumb spur is much weaker than in most species of the genus. From H. oxhyrhina it differs much in coloration and in the longer hind limbs. Thus according to Reinhardt, and Lütken in that species, the proportion of their length to the total is, .107m. to .075m.; that is, 1.33 per cent. In H. lanciformis, the proportion is 1.81. The white margins of the limbs, breast and lower lip as well as the marbled coloration described by these authors; are here entirely wanting. Pebas, Equador. J. Hauxwell's collection.

DORYPHORUS CASTOR, Cope. *Sp. nov.*

Scales of the abdomen weakly keeled, nearly equal to those of the back, which are more strongly keeled. Scales of the sides scarcely smaller than

either. Gular fold moderate, its scales subequal. Mental scales uniform, smooth. No auricular scales; temporal scales rough. Occipital plate large, longer than wide; interorbital series three; muzzle scales large smooth, polygonal, only four rows between canthus rostralis. One canthal scale; two loreal rows; nostril between two scales; labials (large) 5—6. Oblique folds on sides of neck. The arm extended reaches the middle of the femur; the leg, the tympanic drum. Body slender; tail perfectly flat, wider than the body, with 35 cross-rows of keeled scales, which are only produced into spines at the edge of the tail.

Color, blackish olive, gradually lighter to the head, which is thickly black spotted on a green ground. A broad crescentic black collar which is broadly light margined behind, much more indistinctly before. The posterior border is against broadly margined with black behind. Limbs closely green spotted on a blackish ground. Tail uniform brown. Belly black, on the sides dark green, medially, femora dark.

Total length, 0m.093; from muzzle to angle of mandible, .016; to collar, 021; to vent, .06; length fore limb, .032; of hind limb, .038; width head at mandibular angles, 01.

From Pebas Equador; J. Hauxwell's collection.

TRETIOSCINCUS LÆVICAUDUS, Cope. *sp. nov.*

Scales large, those of both body and tail, entirely smooth. Several behind the occipital plates larger than the others. Limbs short. Size about that of the T. bifasciatus.

Color, a dark clear olive above; paler below, a light green band from the temporal region along the canthus rostralis to the end of the muzzle, and another parallel along the upper lip. No other markings.

From Occidental Department, Nicaragua. Discovered by J. A. MacNeil, a successful explorer of that region. Mus. Essex Institute, and Acad. Nat. Science.

This Ecpleopod, differs from its congener T. bifasciatus Dum. in the absence of carinæ on the caudal scales, and in other points, and in the coloration.

HOMALOCHILUS CHRYSOGASTER, Cope. *sp. nov.*

General form quite slender, the head narrow. Scales in forty-three longitudinal series, those of the median larger than the lateral. Occipital and parietal regions covered with numerous enlarged smooth polygonal scales. Two short longitudinal plates represent the frontal; each is in immediate contact with the superciliary of its side, which exceeds it in length. Three pair of supranasals, the anterior not separated from the anterior nasal; six scales in two cross rows in the place of the prefrontals bound the superciliaries and frontals in front. Superciliaries undivided. Nasal a little higher than wide, the apex visible from above. Two loreals, the anterior larger; two prococulars, the superior large, the inferior in place of the summit of the sixth and seventh labials. Four postoculars, the superior bounding the posterior margin of the superciliary. Superior labials fourteen, seventh and eighth entering the orbit. Inferior labials

fourteen ; anterior four, very elongate inward. Gastrosteges, 255 ; anal, 1 ; urosteges, 78.

Color, light fawn brown above, below golden yellow. A series of fifty-four deep brown spots extend on the dorsal region to opposite the vent, and seventeen on the tail, in the individual described. These spots are darker edged and are occasionally confluent into a short irregular band. They are often transverse and are generally twelve scales wide, and three or four long.

Length .0m 665 ; of tail, .108 ; rictus ovis, .016.

From Turk's Island, obtained by my friend, Professor Adrian J. Ebell. This Boa is very distinct from the Homalochili heretofore described, and exhibits a decided tendency to Ungalia, especially to such species as U. dipsadina. The species of Homalochilus Fischer, are ; *H. multisectus*, Cope, Proc. A. N. Science, Philadelphia, 1862, 70. *H. striatus*, Fischer, Abh. Natur. Hamburg. 1856, 101. *H. strigilatus*, Cope, l. c. p. 71 ; *H. chrysogaster*, Cope, supra, and *H. tortilis*, Jan. (*Dendophilus tortilis* Jan. Iconographie des Ophidiens Plate). The last named belongs here, as I learned from a study of the type specimen in the Mus. Milan. It differs very much from the species above described, but I cannot now point out its characters, having mislaid my MS. description. The *Epicrates versicolor* of Steindachner, beautifully figured in the Denkschriften of the Wiener Academie, belongs to this genus, and appears to be *H. strigilatus* m., previously named.

The collection from Turk's Island embraced the following species :
Homalochilus chysogaster, Cope.
Mabuia cepedei, Gray.
Anolis ordinatus, Cope, Pr. A. N. Sci. Phila. 1864, 175.
Cyclura (Ctenosaura) carinata, Harlan Journ. A. N. Sci. IV, p. 242.

I would here notice that Dr. John Gündlach, has published in the Repertorio Fisico, etc., de Cuba, 1868, a catalogue of the Batrachia and Reptila of the Island of Cuba, which furnishes a desideratum of long standing. I observe, however, that he interjects assertions as to the probability of several of my species being synonymes of others, as Anolis porcus, A. isolepis, Liocephalus raviceps and macropus, etc. As I suspect that these suggestions are not original with Dr. Gündlach, I will observe that as a general rule, it is unsafe for American naturalists to rely on assertions of some Continental European zoologists, as to identity of the species of each other, or of American zoologists, since it is an old practice, the offspring of autocracy rather than of science, and which deceives only temporarily.

ENULIUS MURINUS, Cope. gen. et. sp. nov.

Char. Genericus. Palatine, pherygoid, and anterior portion of maxillary bones edentulous ; a long, strong grooved tooth on the posterior part of the maxillary bone. Internasal plates present ; rostral prominent depressed ; two distinct nasals, a loreal, no preocular, two postoculars.

Scales smooth, with one apical pore-pit. Anal plate and subcaudals double.

This genus has head-shields arranged like those of *Rhegnops*, Cope, (Proc. Acad. Nat. Sci. Phil. 1866, 128), but the dentition is entirely distinct. It is nearer to *Tantilla* B. and G. but that genus does not present the edentulus characters, and exhibits a preoccular instead of a loreal plate. The pupil is round. The general form is slender for a Calamarian serpent, and the tail is unusually elongate; the head is not distinct.

Char. Specificus. Scales in sixteen or seventeen rows. Labials 6-7, third and fourth in orbit. Two postorbitals; temporals, 1—2—3. Rostral broad, crescent shaped; internasals half as large as prefrontals. Frontal nearly triangular, with apex behind; anterior border strongly convex. Superciliaries sub-triangular, with short apex anterior. Occipitals elongate. Geneials one pair followed by a row of three scales. The tail measures between one-third and one-fourth of the total length, nearer one-third, but the only specimen now by me has the extremity mutilated. Gastrosteges, 216. Length of a specimen, 0m.220; other larger ones are not now before me.

Color, mouse-color above, white below, a pale spot on each nasal plate, and a dusky one on each side behind the rictus oris. From Chinandega, in the Occidental department, Nicaragua, discovered by J. H. McNiel. Several specimens were taken from a well, forty feet deep.

This species in scutellation and form of head is related to the Calamarinæ, and it is doubtless a borrower, but its scale pores and long tail are exceptional features.

CONTRIBUTION TO THE ICHTHYOLOGY OF THE MARAÑON.

(*Read before the Amer. Phil. Soc. Aug.* 19 1870.)

BY E. D. COPE, A. M.

CHARACINIDÆ.

TETRAGONOPTERUS ORIENTALIS, Cope.

D. 11, A. 29; scales 7–37–8. The depth of the body one-half the length (without caudal fin); the head one-fourth of the same. Dorsal fin above a point a short distance behind the origin of the ventrals. Anterior anal rays not elongate. Diameter one-third length of head, 1.5 times in the convex interorbital width. The extremity of the mandible extends a little beyond the line of the anterior rim of the orbit. Pectoral extending a little beyond basis of ventrals. A broad silver band from upper opening of operculum to caudal, with a black spot near each end. Length 0.097 M.

From Para. Mus. J. Carson Brevoort.

TETRAGONOPTERUS STILBE. Cope.

Depth contained 2.4 times in length (without caudal); length of head 3.5 times in the same. Radii, D. 11, A. 38, scales 8—39—10. Interorbital width equal that of eye, and one-third length of head. Dorsal

fin elevated, a little behind the line of the origin of the ventrals. The maxillary extends to near the line of the anterior margin of the orbit. The anterior radii of the anal fin are elongate. Total length .075 M. Length of anterior dorsal rays .018 M. ; length of anal rays .013 M.

A silver lateral band with a posthumeral and basal caudal spots, the former very distinct.

This species has much the shape of an Abramis; its form is deep, rather abruptly contracted at the extremities, and the supraoccipital region is slightly concave. Allied to the T. abramis of Jenyns.

Para. Mus. J. Carson Brevoort.

TETRAGONOPTERUS HAUXWELLIANUS. Cope.

Radii D. 11; A. 47; squamation 9-10—47—10-11. Depth of body 2.2 times in length, exclusive of caudal fin. Profile above concave; end of muzzle convex. Interorbital width greater than diameter of orbit; eye three times in head. No teeth on the maxillary, which extends only to the line of the anterior margin of the orbit. Caudal peduncle contracted. Color silver olive, with silver white band on side, and indistinct humeral and caudal spot. Total length .056 M.

This is a deep bodied species, with more than usually distinct lateral silver band. Its anal radii are more numerous than in any other species, except the T. spilurus C. V., which differs in having teeth on the maxillary bone, etc.

Dedicated to John Hauxwell, a successful naturalist and explorer, from whom most of the species here described were procured.

Pebas, Equador.

TETRAGONOPTERUS PECTINATUS. Cope.

Radii D. 10, A. 41; scales 4-5—41—6. Form elongate, fusiform, compressed; depth into length without caudal 2.75 times; length of head nearly four times in the same. Interorbital width equal diameter orbit; diameter of eye one-third length of head. Maxillary bone elongate, extending to below middle of pupil, furnished with minute teeth throughout the length of its anterior margin. Profile straight, convex between orbits, muzzle projecting beyond mandible. Dorsal rays prolonged; anterior anals also moderately elongate. The origin of the dorsal is exactly over that of the anal.

A *narrow* silver green band on the posterior half the body; no caudal spot; humeral spot half way between lines of operculum and dorsal first ray. Total length .045 M.

This is a peculiar species, resembling technically only the T. artedii of Cuv. and Val. as described by Günther. This is a more elongate fish, with smaller eye, and other characters. The complete dentition of the maxillary bone is unusual in the genus.

From Pebas, Equador. Hauxwell's collections.

HEMIGRAMMUS ROBUSTULUS. Cope.

Radii D. 10, A. 27; scales 7—35—6. Form deep compressed; length without caudal 2.25 times depth, and 3.5 times length of head. Profile straight, steeply descending to the obtuse muzzle. Interorbital width greater than diameter of orbit; eye one-third of head. Five stout but small teeth on the maxillary bone, which latter reaches to the line of the middle of the pupil, hence the gape of the open mouth is greater than in some other species. The dorsal fin is not so elevated as in some species of Tetragonopterus, and originates behind the line of the ventrals. The greatest elevation of the dorsal line is in advance of its origin. Suborbital bone large; mandible longer than muzzle.

Muzzle black; cheeks black punctate; body brown, a greenish lateral band with indistinct humeral and caudal spots. Middle of caudal fin blackish. Total length .051 M.; to origin ventrals .018 M.; to origin of anal .025 M.

This little Characin I refer to the genus Hemigrammus of Gill,* because

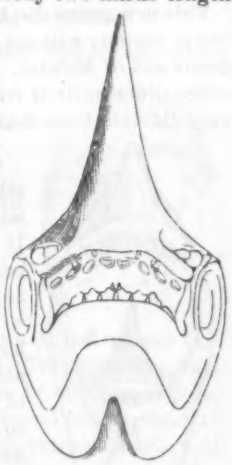
* Ann. Lyc. New York, 1858.

the lateral line is only half developed, extending in the present species to beneath the middle of the dorsal fin. The general form and dentition are stout. The gill rakers are elongate on the inferior, but sparse and short on the superior limb of the hyoid arches.

From Pebas, Equador. Numerous specimens from Hauxwell's collection.

MYLETES LIPPINCOTTIANUS. Cope.

Radii D. 16, A. 39; lateral line 80. Depth of body two-thirds length without caudal; thus the form is discoid. Muzzle very obtuse; mandible longer. Orbit one-third of head, and 1.5 times into very convex interorbital region. Thirty-two ventral spines. Adipose fin two-thirds the length of the rayed dorsal; caudal with a very narrow sinus-like emargination above the middle of the edge. Ventrals not reaching vent, commencing a little in advance of the line of the first dorsal ray.



Color yellow silvery; dorsal region with steel reflections; a dusky spot above the middle of the pectoral on the lateral line.

The teeth of the external premaxillary series are very small, and in close contact with those of the second.

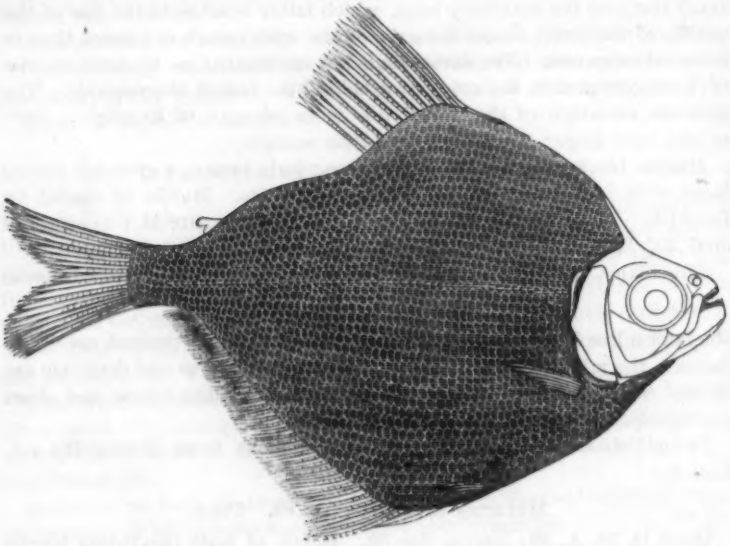
Length .112 M. to line of origin of anal .057; depth .068; do. of head at orbit .022 M.

From Para, Brazil, J. C. Brevoort's collection.

Dedicated to my friend, James S. Lippincott, author of important contributions to Meteorology, Agriculture and other subjects.

STETHAPRION ERYTHROPS. Cope gen. et sp. nov.

Character genericus. Dorsal not elongate, anal prolonged. Premaxillary teeth compressed, lobed, in two rows; no maxillaries. Mandibulars lobed, without conic teeth posteriorly. No keel of spines on the ventral region. Branchial fissures extended.



This new genus displays most of the characters of Mylesinus Cuv. Val., but is entirely without the exposed ventral spines characteristic of that genus and of Myletes. The trenchant four-lobed molars of the posterior series differ entirely from those of Myletes; the dentition, indeed, is not very different from that of Tetragonopterus.

Character specificus. Radii; D. 12; A. 40; squamation 21—61—21. Form discoid, abdominal outline more convex than the dorsal, which is irregular. It is convex above the nape, descending along the base of the dorsal fin, convex in front of the adipose, and concave behind it. Depth 1.5 times in length without caudal, head 3.66 times in the same. Eye large, not quite equal to the diameter of the moderately convex interorbital space, 2.5 times in length of the head. The maxillary is elongate, and extends to the line of the anterior margin of the orbit. The denticulations of the teeth are apical, those of the mandibulars four or five in number. The outer teeth of the anterior premaxillary series small. Ventrals small, below the line of origin of the dorsal. Adipose fin small, caudal furcate. Anal fin narrow, not lobed, anterior radii moderately elongate.

Color silvery, anal fin dark edged; a brighter band on caudal peduncle, darker edged above. An indistinct postscapular spot. Total length .095 M. The color of the irides in the type specimen, which has not been very long in alcohol, is a dark red.

There is a spine directed forwards from the base of the first dorsal ray, along the back, which is free for more than the eighth of an inch.

From Pebas; J. Hauxwell's coll.

HOLOTAXIS MELANOSTOMUS. Cope gen. et sp. nov.

Char. Genericus No adipose fin; origin of dorsal fin posterior to that of the ventral. Teeth on the premaxillary, maxillary and mandibular bones, all simple conic, those of the first and last, in two rows. Suborbital bones very large; gill opening large. Scales without lateral line.

This genus is simply Pyrrhulina with maxillary teeth.

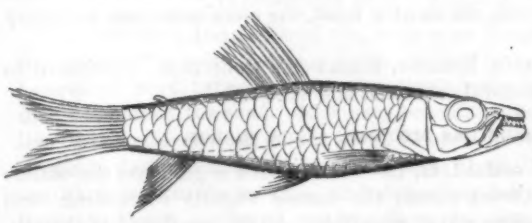
Character specificus. Rather elongate; depth .0125 M.; length .07 M., length of head .014 M.; width of do. behind .0065 M. Radii D. 9.; A. I. 10; V. 8. Scales 7—25. Above brownish, below yellowish; on the sides the scales with orange bases and brown edges forming longitudinal lines. A black band through the operculum and orbit round the edge of the premaxillary; another round the edge of the mandible. A black spot on the middle of the dorsal fin.

This species is evidently near the Pyrrhulina filamentosa of Cuv. and Val., but the caudal fin is regularly emarginate, and has not the peculiar form ascribed to that species by those authors.

Numerous specimens from Pebas, Equador, Hauxwell's coll.

PLETHODECTES ERYTHRURUS. Cope gen. et sp. nov.

Character genericus. Adipose fin present, dorsal short, originating



above the ventrals. Anal short. Lateral line present on the inferior row of scales; belly not compressed; gill opening wide. Teeth on the maxillary, premaxillary and dentary bones. Maxillaries in one row, simple, conic; premaxillaries in two rows, those of the external simple conic, of the inner tricuspid; mandibulars in an outer row of tricuspid teeth, and two simple conic in the middle behind them. Maxillary arch angulate, the maxillary bones extending downwards on each side of the dentary.

This genus appears to be nearest to Piabucina Cuv. Val. It differs in

the presence of the lateral line, and in having two series of premaxillary teeth instead of one, of which the external is simple and not tricuspid. There are also two series of teeth on the dentaries of Piabucina. The suborbital bones of this genus are large.

Character specificus. Form medium, head elongate, broad and flat above, interorbital width 2.5 times in length. Diameter of orbit nearly three times in length of head, equal to length of muzzle. Length of head one-third of total without caudal fin. Greatest depth one-fourth of same. Scales large, l. series 6 at ventrals; transverse (above l. line) 16. Radii, D. 12; A. 11; V. 9; caudal deeply forked.

Color light olive; top of head and muzzle, ventral, anal, and dorsal fins blackish. Caudal fin red, dusky medially.

There are three longitudinal ridges on the cranium above, of which the median is very weak. Total length 0 M.068; length to opercular margin, .0175 M.; to basis of ventral, .0285 M.; to basis of anal, .042 M.; to bases of caudal, .052 M. From Pebas, Equador; Hauxwell's collection.

APHYOCHARAX FILIGERUS. Cope sp. nov.

Head small, the length contained five times in total, without caudal fin; height 4.25 times in the same. Eye three times in length of head, a little exceeding muzzle. Dorsal fin originating half way between lines of origin of ventrals and anal. Anal long, the anterior rays much prolonged, filiform, extending backwards to the last fifth of the length of the base. Dorsal elevated; Radii, D. 10; A. 28. L.l. scales 38; tubes on a few of the anterior only; l. tr. 12. Premaxillary teeth seven on each side, maxillaries numerous, occupying most of the margin of the bone. Color olive above, yellowish below, lower lobe of caudal blackish. Length 0M. .06.

This, the second species of this genus just described by Günther (Proc. Zool. Soc. London, 1868, 245), differs from the type species, A. pusillus, in the longer anal fin (there are only 18 rays in the latter), with much prolonged anterior radii, the shorter head, the more numerous maxillary teeth, &c.

From Pebas, Eastern Ecuador, Hauxwell's Collection. Dedicated to the discoverer, a successful naturalist and explorer.

ROEBOIDES BICORNIS. Cope sp. nov.

Radii D 11, A 51; scales l. tr. 18—16; the back is gibbous; the outline of the front plane; the muzzle slightly descending, and overhanging the mandible; depth one-third of length, without caudal fin; length of head 3.5 times in same; eye large, 3.5 times in head; inter-orbital region narrower, convex; two horn-like teeth projecting forwards; two small ones on each side posteriorly, directed outwards; mandible with four equal conic processes; mandible with four canines; premaxillary teeth irregular, maxillaries sparse; pectorals and ventrals extending beyond basis of anal; length 0.07 M.; to ventrals .02 M.; to anal .025 M.; origins of dorsal and anal opposite.

Color pale, with a silver lateral band, and black humeral and basal caudal spot.

Pebas, Eastern Equador, Hauxwell s Collection.

This species is near the R. myersii Gill, M.S., but is a shallower fish, with smaller eye, and fewer horns on the upper jaw. The Hystricodon xenodon Reinhardt, Vidensk. Med. Kjobenhavn, 1849 37, has much larger scales.

ANACYRTUS TECTIFER. Cope sp. nov.

Radii ; D. 11 ; A. 37. Scales from basis of dorsal to basis of anal 12—10. A short, deep species ; depth 3.2 times in length, without caudal fin ; head 3.6 in the same ; eye 3.75 times in length of head ; equal interorbital width ; head elevated, front slightly concave in profile, end of muzzle descending ; scales rather large ; ventrals reaching anal fin, pectorals not Maxillary teeth numerous, equal, premaxillary series confluent, three canines on each side ; mandible with two on each side ; mandible longer than muzzle, when open.

White, without silvery lateral band ; inferior half operculum golden ; a large black spot in front of the origin of the dorsal, on the side : a black spot at the basis of caudal ; ante-orbital region punctulate ; length 0.M. 068 ; to end of maxillary .0075 M. to origin of ventral fins .0225 M. ; to origin of anal .031 M. The origin of the dorsal is in advance of the line of the origin of the anal. Its last ray is much behind the latter point.

This species is named from the fact that the free anterior margin of the nasal bones is more prolonged than in other species, and overhangs the nares and premaxillaries. The few anal radii and coloration also distinguish this fish from its allies.

Pebas, Ecuador. Hauxwell's Collection.

CYNOPOTAMUS GULO. Cope sp. nov.

Form slender ; the depth of the body near three-fourths the length of the head, four and one-third times in the total, without caudal fin. Length of head three and a quarter times in the same. Eye 3.75 times in the length of the head. Maxillary bone extending a little beyond the line of the posterior rim of the orbit. Fourteen rows of scales between origin of dorsal and lateral line. Fin radii D. 12, A. 41. The profile of the head is scarcely concave and slopes regularly to the premaxillary border. A few scattered canines form an inner premaxillary row. There is a canine at each end of each premaxillary of the outer row. The outer mandibular row consists of four equidistant canines on each side in front, and numerous small teeth behind.

Color pale. Lower half the opercle golden. A black humeral spot, and a silver lateral band extending from it to the caudal fin, at the base of which is a black spot.

Length 0M .09. To opercular margin .025. To origin dorsal (vertical line) .035. To origin of anal .044.

From Pebas, Eastern Peru. Numerous specimens from Hauxwell's Collection.

Other Characinidæ contained in the collection are, Macrodon trahira Spix; Erythrinus brevicanda, Günth; Hydrocyon sp. indet; Myletes duriventris Cuv.; Tetragonopterus ortonii, Gill M.S.S. Proc. A. N. Sci., Phila., 1870; Gasteropelecus stellatus Kner; Chalcinus brachypomus, C. V.; Leporinus frederici, Bloch; Curimatus sp. indet.

The Characins obtained at Para by De Schulte Buckow for J. Carson Brevoort's Collection, already mentioned, are Leporinus striatus Kner.; L. megalepis, Gunth.; Schizodon fasciatus, Spix; Tetragonopterus lepidurus Kner.; T. fasciatus; T. stilbe, Cope, T. Gasteropelecus sternicla L.; Chalcinus brachypomus C. V.; Myletes lippincottianus, Cope; Serrasalmo piraya; Serrasalmo maculatus, Kner. The last agrees closely with Kner's figure and description, except that the young only is spotted, and the caudal fin of young and adult are yellow-edged outside the blackish cross band.

ODONTOSTILBE FUGITIVA. Cope gen. et. sp. nov.

Char. Gen. Teeth in a single series on the premaxillary and dentary bones only, broadly spatulate and crenate. Anal fin elongate. Lateral line continued to the caudal fin.

This genus differs from *Chirodon* (Girard) chiefly in the complete development of the lateral line of tubules.

Char. Spec. D. 10, A. 24, l.l. 35. Transverse line at vent 11; at ventral fins 5—5. Teeth, two on each maxillary, five on each premaxillary, and six on each dentary. The premaxillaries with seven cusps each, the median more prominent. Those of the other bones with similar cusps of more equal length. Depth of body 3.5 times in length, exclusive of caudal fin. Head four times in the same, its profile convex longitudinally and transversely, with interorbital width equal diameter of orbit. Latter 2.5 times in length of head. Caudal fin deeply forked. Ventral just in advance of below first dorsal ray. Pectoral barely reaching ventral. Olive silvery, with a silver band, dark-edged above and below, from opposite middle of pectoral fin to basis of caudal. A dark spot at latter point. Cheeks silvery. Length two inches.

Pebas, Eastern Equador. Hauxwell's Collections.

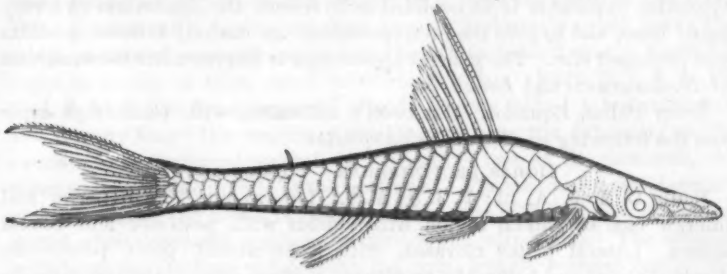
This little Characin is allied to the *Chirodon alburnus*, Gthr. (P. Z. S. Lond. 1869, 424,) but has teeth on the maxillary, fewer and differently formed on the other bones, more anal radii, different proportions, etc.

SILURIDÆ.

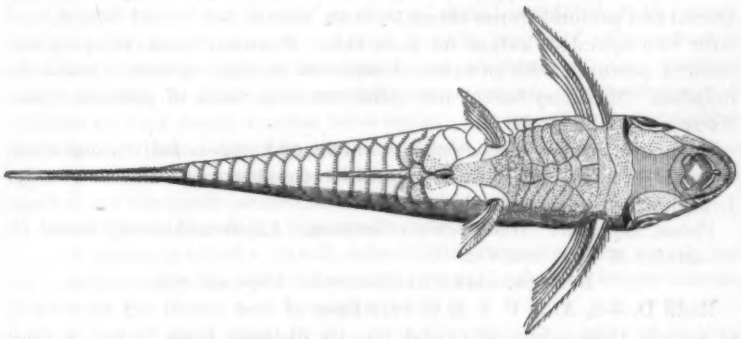
HYPOPTOPOMA BILOBATUM. Cope sp. nov.

Character.—Form rather slender. Adipose fin reduced to a microscopic spine. Teeth numerous, $\frac{24+?3}{23}$ on each side of the mouth. Caudal fin deeply forked, with nearly equal lobes.

Description,—Radii, D. I. 7, A. 6, P. I. 6, V. I. 5. Two rows of plates of the lateral line to a little behind the anal fin; then one row. Transverse series 24 to caudal. Three plates between occiput and dorsal fin.



Fourteen plates across dorsal line behind dorsal fin. Sutures of vertex obliterated, but those on each side of the suture rising from the middle of the orbit are of equal width. Three plates along each canthus rostralis, with a median rostral. Temporal region rugose. Sides and muzzle below, with close, card-like spinules. Plates everywhere comb-like behind. Spines and outer radii of all the fins, spinulose. The pectoral spine is, in addition, serrate on the inner margins.



Length of head to occiput 3.5 times in total less caudalis; width behind pectorals five times, and depth at dorsal 7.5 times in the same. Orbit round, one-third of interorbital width. Pectorals to middle of ventrals; ventrals to beyond vent, but not to anal fin. Basis of dorsal twice to adipose spine (!), which is small, articulating in a groove in the summit of the interhæmal bone, which appears between the shields. First dorsal ray weak, jointed distally.

Interoperculum very large, entirely inferior. Thoracic bones covered with rugosities, separated externally. Three rows of abdominal plates, four in the first cross-row.

The lobes of the caudal fin are acute and nearly equal. Length four inches. Color olive, top of head and dorsal region darker. A black spot in the middle of the caudal fin.

This is the second representative of a remarkable genus recently described by Günther (Proc. Zool. Soc. London, 1868, 234), and which has as yet been found only in the upper Amazon and its tributaries. The opercular apparatus is so modified as to reduce the operculum to a very small bone, and to give the interoperculum an entirely inferior position and increased size. The general appearance is intermediate between that of *Hoplosternum* and *Loricaria*.

From Pebas, Equador. Hauxwell's collection, with *Callichthys asper* and the following species of *Nematognathi*.

DORAS PECTINIFRONS. Cope sp. nov.

Radii D. I. 5, A. 12; P. I. 5; V. 6. Lateral line 27. Superior and inferior face of caudal region with shields with posterior and lateral spines. Lateral plates elevated, with a prominent point posteriorly directed above and below the prominent median spine. On the anterior half the side one to three series of irregular posteriorly directed spines above the lateral series, and a few irregular ones below it. Margins of the cephalo-nuchal shield prominent all round, often recurved, rugose; pectinate above the orbits, and at the posterior projection on each side the dorsal fin. Two serrate ridges mark the premaxillary spines, and the preorbital bones are crested laterally and superiorly, the superior crest comb-like. Preopercular angle with a serrate crest; scapula serrate. Dorsal and pectoral spines elongate, both serrate before and behind, and with two spinulose ridges on each side. Humeral spine reaching last third of pectoral, with an external series of straight spines. Caudal fin rounded. Maxillary barbel not quite reaching basis of pectoral spine. No spine in adipose dorsal.

Color everywhere black, gular, thoracic, and abdominal regions white spotted. Caudal fin with a yellowish cross-bar near the extremity. Length of type specimen three inches.

Pebas, Equador. Hauxwell's collection. Allied technically to the *D. armatulus* of Cuv. and Val.

BUNOCEPHALUS ALEUROPSIS. Cope sp. nov.

Radii D. 5–6, A. 9, P. I. 4, C. 10. Base of first dorsal ray nearer end of muzzle than origin of caudal fin; its distance from former a little more than .4 of total length. Maxillary barbel extending to near the middle of the pectoral spine. Width of head at preopercula 5.66 times in length, exclusive of caudal fin. Length of caudal fin 5.75 times in total length. Length of head to operculum 6.1 times in total (without caudal). Five series of wartlets along each side of the tail. Tail wide as deep medially, compressed distally. Length four inches; greatest (scapular) width a little less than .25 of the total (with caudal fin).

Color brown, the head densely punctulated with white above. Sides and back with dark brown blotches. Dorsal fin with extremities of anal and caudals, black or blackish.

From Pebas, Eastern Equador. John Hauxwell's collection.

This species is near the *B. gronovii* Bleeker, but has different radial formulæ and larger maxillary barbels, etc. In the latter the fins have, according to Günther, D. 5, A. 6, P. I. 5.

PSEUDORHAMDIA PISCATRIX. Cope sp. nov.

Head above granular rugose, except between and in front of the prefrontals. Occipital process convex, not keeled, apex in contact with basal dorsal shield; its length exceeding a little its width at the base. Head narrow, with narrow truncate muzzle and nearly equal jaws; the width at base of pectoral spines equal length to behind orbit. Orbit 3.3 times in length of head, equal interorbital width. Radii D. I. 6, A. 12, P. I. 9, V. 6, not reaching anal. Caudal deeply forked lobes subequal. Beards very long; the maxillary reaching to near the extremity of the caudal fin, the external mentals to beyond the base of the pectorals, the inner to beyond the middle of the pectorals. The pectoral spine is serrate on both edges; the dorsal on the posterior only. The longest ray of the dorsal when depressed reaches the base of the adipose fin. The adipose subtriangular, its base one-seventh the total length, without caudal fin. Head to opercular opening 3.75 times in length to basis of caudal fin. Length five inches. Pebas.

RHAMDIA CYANOSTIGMA. Cope sp. nov.

Radii D. I. 6, the spine not thicker than the other rays, and weaker than the pectoral; A. 12, V. 6; P. I. 8; its spine minutely serrate within and without. Top of the head smooth, or with a slight rugosity on the postfrontal region. Head to operculum a little more than .2 of length to basis of caudal fin; length to basis of dorsal one-third of the same. Depth of body 7.33 times in the same length; length of adipose fin 3.33 times in the same. Depressed dorsal not reaching adipose; pectoral reaching only .66 distance to ventrals; latter reaching half way to anal. Caudal fin very deeply furcate, lobes equal. The maxillary barbel reaches to near the end of the adipose fin. Length four inches; general form slender. Color plumbeous; head above blackish, with an iridescent blue spot above the posterior margin of the orbit on each side.

From Pebas, Equador. Hauxwell's collection.

This species is allied to the *R. dorsalis* Gill, from the same region, but is a more slender fish, with more numerous anal radii and longer barbels.

CHROMIDIDÆ.

CRENICICHLA CYANONOTUS. Cope sp. nov.

D. xxiv. 11, A. III. 8; scales 5–66–13. Depth of body 6.25 times in total length; length of head a little more than four times in the same. Orbit large, equal length of muzzle, 3.75 times in length of head, a little less than interorbital width. The head is thus broad and short; above quite plane. Scales of body rather large, seven rows on the cheek. End of maxillary marking anterior third of orbit. External teeth stronger. The ends of the pectoral and ventral fins mark the thirteenth dorsal spine. The longest dorsal spine equals the length of the premaxillary bone with spine. Color olive, with seven indistinct brown cross-bands directed obliquely backwards to the middle line of the side. A dark band from orbit to axilla. A black, white(?) edged spot on the upper caudal radii. Dorsal and anal fins without spots, blue at the base. Length six inches.

From the upper Marañon, near Pebas. John Hauxwell's collection.

CRENICICHLA LUCIUS. Cope sp. nov.

Radii D. xix. 13; A. III. 10. Squamation 4—64—13. Depth of body one-seventh of total length. Length of head three and a half times in the same. Head elongate, pike-like, the mandible strongly projecting, the outer series of teeth not larger than the others. Orbit, diameter less than length of muzzle, nearly five times in length of head, equal inter-orbital width. Length of longest dorsal spine three-fourths that of the premaxillary bone with spine. Scales large, eight rows on the cheek. Maxillary bone reaching the anterior fourth of the orbit. Ventral and pectoral fins marking the eleventh dorsal spine.

Color olivaceous, above brown. A darker band from muzzle to opercular angle. A black spot *at base* of caudal radii, edged with yellow. Dorsal and anal fins unspotted. Length six inches, width of head behind .75 inch.

This species is near the *C. lacustris* of Castelnau's fine work, and differs in the following points. The latter is a less elongate species, the depth being only one-sixth the length. The scales are less numerous, counting 4—51—11. There is a brown spot on the middle of the dorsal fin, and some longitudinal shades on the posterior part not found in the *C. lucius*.

Both species were sent by John Hauxwell from the tributaries of the Upper Maranon, in Equador.

ACARA FLAVILABRIS. Cope sp. nov.

Three series of scales on the cheek. Radii D. xvi. 10. A. III. 8 squamation 3—26—9. Depth 2.25 times, head three times in length without caudal fin. Orbit, diameter a little exceeding muzzle, one-third length of head; inter-orbital width two-fifths the same. The length of the longest dorsal spine is equal to that of the muzzle.

Color brown, several darker cross shades across the dorsal region; a large black ocellus on lateral line. No other spots. Fins dusky. Lower lip yellow. Total length four inches; depth of head 1.1 inch. Front slightly convex in profile.

From near Pebas, Equador, John Hauxwell's Collections. It was associated with several specimens of *Mesops taeniatus*, Günth, (Catals. B. M. iv. p. 312), from the same locality. In the same collection occurred *Rivulus micropus Steind. var.*, *Sternopygus macrurus*, *S. virescens* and *Carapus fasciatus*.

TETRAODONTIDÆ.

TETRAODON PSITTACUS L.

Cheilichthys (Müll). Steind. Verh. Zool. Bot. Ver. Vienna 18, p. Tab.

This species was brought by Natterer from some of the fresh waters of Brazil, according to Steindachner. It occurs in the present collection from Equador, from a point 2,300 miles from salt water.

EXPLANATION OF WOOD CUTS.

Fig. 3. *Myletes lippincottianus*, Cope, mouth showing dentition.
Fig. 4. *Odontostilbe fugitiva*, Cope, ibid.
Fig. 5. *Stethaprion erythrops*, Cope, natural size: 5a, mouth with dentition.
Fig. 6. *Piethodectes erythrurus*, Cope, natural size; 6a, mouth with dentition.
Fig. 7. *Rœboides bicornis*, Cope, mouth with dentition.
Fig. 8. *Hypoptopoma bilobatum*, Cope, natural size: 8a, same seen from below.

Stated Meeting, December 2d, 1870.

Dr. G. B. Wood, President, in the Chair.

Present, fourteen members.

A letter of acknowledgment was received from the R. Danish Society of Sciences, dated November 5, 1870 (81, 82, xiii. 3).

Donations for the Library were received from the Prussian Academy; Silliman's Journal; the Connecticut Academy; the American Oriental Society; Mr. James J. Barclay, of Philadelphia; and Dr. Rushenberger.

Dr. H. C. Wood presented for publication in the Transactions of the Society a Monograph of the Fresh Water Algæ of the United States, which was referred to a Committee consisting of Dr. Carson, Dr. Bridges, and Mr. Durand.

Dr. Pepper communicated "Observations upon a Skeleton," exhibiting a unique case of Universal Hypostasis associated with Osteoporosis, illustrated by Drawings. Dr. Leidy, Dr. Coates, and Dr. Allen were appointed a Committee to act in conjunction with the Secretaries respecting the publication of this paper.

Prof. Cope communicated a paper on the Fishes of the Fresh Water Tertiary in Idaho, discovered by Capt. Clarence King; and another on the Adocidæ.

Prof. Cope made the following verbal communication on fossils, which he exhibited and described:—

Prof. Cope exhibited vertebræ of two species of Pythonomorpha, the largest known to exist. One of these, *Mosasaurus maximus* Cope, from the New Jersey Cretaceous, was represented by vertebræ, whose centra were 3.5 inches in diameter across the articular extremities. Those of *M. missuriensis* Harl. measured 2.5 inches in a specimen of seventy-five feet in length, according to W. E. Webb; so that the *M. maximus* probably exceeded that length. This measurement was also confirmed by statements of persons engaged in digging marl in New Jersey. The second species exhibited was still larger, and appeared to belong to the genus *Liodon*. The diameter of the convex articular extremity was more than 5.5 inches, indicating a great length for the animal, perhaps one

hundred feet. It was named *L. dyspelor* Cope. The centra were depressed in the dorsal region, and had the smooth margin bordering the ball and rugose surface within this band. An emargination for the neural canal. Caudals pentagonal anteriorly, becoming soon higher than wide. From near Fort McRae, New Mexico.

Several other species of the order had recently been found by Prof. Mudge in Kansas. Two of these were *Liodons*, and were named *L. ictericus* and *L. mudgei*, respectively. The former was allied to *L. validus* Cope, having depressed dorsal vertebræ; but the quadrate bone had a less prominent and more medially placed external angle and ridge. The *L. mudgei* had depressed vertebræ; but the external angle of the quadrate more posterior, and not continued so far down. The third was a Clidastes, much the largest of the genus, nearly equalling the *Liodon validus* in size, and differing from the described species in the lack obliquity of the articular extremities, and other points. He named it *Clidastes cineriarum* Cope.

The Treasurer's report was read.

Prof. Trego, Chairman of the Publication Committee, read the report of that Committee; when,

On motion, the Committee was instructed no longer to forward copies of the Transactions to delinquent subscribers, after due notice given.

Pending nominations Nos. 661, 666, and new nominations, Nos. 667, 668, were read.

And the Society was adjourned.

Special Meeting, December 9th, 1870.

Dr. Wood, President, in the Chair.

Present, twenty members.

The Preamble and resolutions for considering which this meeting was called, were read, debated, and withdrawn by Mr. Cuyler, by permission of the Society.

It was then on motion of Mr. Cuyler,

Resolved, That a Committee consisting of the President of the Society and five members be appointed, whose duties it shall be to consider and report whether it is desirable, and if desirable, whether it be practicable

to establish in the city of Philadelphia, under the auspices of the Society, an Observatory, Astronomical and Physical, either or both, and if so at what cost, on what site, and what instruments are requsite for such purposes, and at what cost such instruments can be procured.

The following gentlemen were nominated and on motion appointed to constitute said committee; Mr. Cuyler, Prof. Frazer, Prof. Henry, Prof. Kendall, and Mr. Fairman Rogers.

And the Society was adjourned.

Stated Meeting, December 16th, 1870.

Dr. G. B. Wood, President, in the Chair.

Present, fourteen members.

Letters of acknowledgement were received from the Emden Nat. Hist. Society (77–80), the Buenos Ayres Museum (78, 79, 80), the Soc. Antiquaries, London (82), and the Nat. Hist. Soc. at Newcastle on Tyne (82).

Letters of envoi were received from the Emden N. H. Society, Oct. 1, and the Bureau of Geological Research of Sweden, Stockholm, May 1st, 1870.

A printed Circular memorial in behalf of the collections in Paris, threatened by the bombardment, was received from the Provost and professors of Trinity College and the University of Dublin.

Donations for the Library were received from the Imp. Russian Academy, the Nat. Hist. Soc. at Moscow, the Austrian Geological Ins., Dr. Heidinger of Vienna, the Observatory at Prague, the Societies at Emden and Frankfort, the Societies of Science and Antiquities at Copenhagen, the Swedish Geological Bureau, the R. Lombard Institute, the Institute at Venice, M. A. de la Rive of Geneva, the London Geographical Soc., the Meteorological Committee of the R.S., and the Editors, of Nature, the Hist. Soc. at Quebec, the Essex Institute, Boston N. H. S., New Jersey Historical Society, Prof. A. M.

Mayer of Bethlehem, the Medical News and Penn. Monthly, Peabody Institute in Baltimore, Surgeon General's Office in Washington, the Publishing Bureau of the U. S. Commissioners to the Paris Int. Exp. of 1867, War Maps from the Chief Engineer's Bureau in the War Office, a map of Ohio from Prof. Newberry, and the Annals of the Buenos Ayres Public Museum.

The Committee to which was referred the paper of Dr. Horatio C. Wood on Fresh water Algæ, reported in favor of its publication in the Transactions. The subject was, on motion, referred to the Publication Committee with instructions to report at the next meeting.

An obituary notice of Mr. Franklin Peale, a late member of this Society, was read by Mr. Robert Patterson.

An obituary notice of Mr. Samuel Vaughan Merrick, a late member of this Society, was read by the Rev. Dr. Goodwin.

Prof. Cope made a communication on certain extinct Astici from the Fresh water Tertiary of Idaho. And another on four species of Pythomorphia from the Cretaceous of Kansas.

The reading of the report of the Finance Committee was, on motion, postponed to the next meeting.

Mr. Marsh, Treasurer of the Building Fund Trust, presented the annual Report of the Trustees.

Pending nominations 661 to 668 were read.

Motions for appropriations for the ensuing year were postponed to the next meeting.

And the Society was adjourned.

ON SOME SPECIES OF PYTHONOMORPHA FROM THE CRETACEOUS BEDS OF KANSAS AND NEW MEXICO.

BY PROF. E. D. COPE.

Read before the American Philosophical Society, December 18th, 1870.

LIODON DYSPELOR. Cope.

Species nova.

This species is represented by numerous vertebræ of the dorsal, lumbar, and caudal regions, and other remains, which will at a future time be more fully described than is possible at present. The vertebræ indicate the largest Mosasauroid reptile known, and are remarkable for their form as well as size.

The centra of the dorsals are much depressed, quite as in *L. perlatus*, Cope, and *Mosasaurus brumbyi*, Gibbes. Their articular faces are of transverse lenticular form, the superior arch being a little more convex than the inferior, and obtusely emarginate for the floor of the neural canal. The superior outline is thus bilobed; the lobes rounded. The transverse curvature of the articular ball is quite regular, and not, as in *Mosasaurus maximus*, more steeply inclined at the external or lateral angles. A rather broad, smooth band separates the edge of the ball from the surfaces of the centrum adjacent. The latter are rather finely striate ridged from the edge of this band. The inferior outline of the centrum is strongly concave, and with two venous foramina separated by a wide interval. The basis of the diapophysis on a lumbar is very broad, measuring more than half the length of the centrum. In general characters this lumbar resembles the dorsal, including the emargination for the neural canal, but is shortened in relation to its length.

The depressed form of the lumbar centra gives place gradually on the caudals to a more elevated pentagonal outline, which is still more reduced in width in more posterior regions. The hæmal arches are articulated, and on the anterior caudals to slightly elevated bases; on the more posterior, the bases are reduced in height, and more widely and deeply excavated. I have not seen the most distal caudals, and hence cannot determine whether their chevron bones articulate in pits, as is the case with those of *L. perlatus*, *L. proriger*, etc. On a caudal where the depth of the centrum a little exceeds the transverse diameter, the diapophysis has become narrow and thick. The excavation for the neural canal is strongly marked on the more anterior caudal. The smooth border of the articular ball is here narrow, and the superficial rugæ are fine, and confined to the anterior part of the centrum.

Measurements.	*M.*
Transverse diameter ball posterior dorsal	0.144
Vertical "	.097
" " anterior caudal	.094
Transverse " " "	.107
Length centrum caudal	.071
Transverse diameter neural canal	.0145
" " basis diapophysis	.032
" " " " of a more distal caudal	.0278
Longitudinal diameter chevron articulation of caudal	.023
Length centrum	.068
Depth ball centrum	.093
Width " "	.091
Length centrum of a lumbar	.106
Width of articular ball	.125

In instituting a comparison between this and other known Mosasauridæ, it will be necessary to consider species referred to Mosasaurus as well as to Liodon, from the fact that some of the former may really be Liodons.

The Liodons with compressed or round dorsal or lumbar vertebræ may be dismissed from comparison. Of the depressed species, *L. perlatus*, Cope, is known from specimens of one-third or less the size of the present one, which are further peculiar in having the diapophyses of the lumbars to stand on the anterior half only of the centrum. In *L. ictericus*, Cope, the centra are less depressed, and the size still smaller than in the last.

Among Mosasauri with depressed vertebral centra, it is to be noted that none present so great a degree of depression and lateral extension except the *M. brumbyi* of Gibbes. They are all also much smaller. The *M. brumbyi* was founded by Dr. Gibbes on two lumbar vertebræ from the Cretaceous of Alabama, which resemble those of the *M. dyspelor* in form, and also in size. It is probably its nearest ally, and may be a Liodon. Dr. Gibbes established the genus Amphorostens for it, but without sufficient evidence to support it. The principal point of distinction between it and the *L. dyspelor* which I observe is the lack in the former of the strong emargination of the superior margin of the articular surface for the floor of the neural canal, which is so marked in the latter. I have only the figures of Gibbes to rely on for this particular, and it is scarcely probable that the artist would have overlooked it had it existed. Should the bounding prominences have been worn off, then the restored centrum would have had a notably greater vertical diameter than in the *L. dyspelor* in the same portions of the vertebral column. As a second character, I note that, relying as before on Gibbes' figures, the external angles of the depressed ball are not so extended laterally in *M. brumbyi*.

In size the vertebræ of the present animal exceed those of the *M. brumbyi*. The latter has been hitherto the largest known species of the order Pythonomorpha, exceeding two-fold in its measurements the *M. giganteus* of Belgium. So the present saurian is twice as great in dimensions as the New Jersey species I have called *M. maximus*. If, as appears certain, the *M. missuriensis* discovered by Webb measures seventy-five feet in length, the *M. maximus* measured eighty, and the *M. dyspelor* could not have been less than one hundred feet in length. This is much the largest reptile known, and approaches very nearly the extreme of the Mammalian growth seen in the whales, though of course without their bulk. Such monsters may well excite our surprise as well as our curiosity in the inquiry as to their source of food supply, and what the character of those cotemporary animals preserved in the same geologic horizon.

The locality whence this reptile was procured is near Fort McRae, in New Mexico. It was discovered by Dr. W. B. Lyon, surgeon at that post, and by him sent to the Army Medical Museum at Washington, whose director placed it in the collection of the Smithsonian Institution. The attention to the palæontology of his neighborhood by Dr. Lyon will always be cause of satisfaction to students, and his name will be remembered with that of Turner (discoverer of the *Elasmosaurus platyurus*, Cope), Sternberg, and others.

The stratum is the yellow chalk of the upper cretaceous, which has yielded the *L. ictericus*, *L. proriger*, *Polycotylus*, etc., in Kansas, and of

whose western extension into New Mexico, the present species is evidence.

LIODON ICTERICUS, Cope.

Char. External angle of the os quadratum close by the meatus, and continued as a rounded ridge separating the anterior and external faces of the bone. Median posterior ridge not prominent. Centra of dorsal vertebræ depressed. Humerus broad, short.

Description. This species is represented by portions of cranium, as postfrontal, suspensorial, pterygoid, articular, and quadrate bones; by parts or wholes of several vertebræ, which are all dorsals, and by scapula and coracoid with many elements of the fore limb. The latter include humerus, radius, a carpal and numerous metacarpals and phalanges.

The species is first well characterized by the form of the quadrate bone. This element lacks a portion of the ala, and the postero-superior decurved process, but is otherwise perfect. Its form is intermediate between that in *L. validus*, Cope, and *Mosasaurus depressus*, Cope. Its external angle of the proximal extremity is posterior to its usual position, as in the former species, but is less prominent than in it. It extends to near the distal end, disappearing between the extremities of the median posterior, and the distal longitudinal angles. The former of these is short, and it disappears by a gradual descent distally, in a very rugose margin. The distal longitudinal is short and acute, not prominent at the distal extremity. From the posterior position of the proximal external angle, the alar articular surface is somewhat elongate. The postero-external face above the meatus is proportionately short. The meatal pit is scarcely one fifth the usual size, so far as determinable from the present surface, but it is possible that the greater part is filled by an impacted mass of bone derived from the adjacent ridge. The margins of the articular extremities and of the ala are striate and papillose rugose. No meatal knob.

The suspensorium is slender. It is peculiar in the great extent of the exoccipital element, which covers the whole superior surface, and extends externally over the opisthotic to the squamosal, concealing the former except its anterior margin. The proötic sends a small proximal portion only to the superior face.

The pterygoid has been free from its fellow medially. A distal and median portions have been lost; the remaining fragments present bases and alveolæ for eleven teeth. The fangs are rugulose and but little swollen; probably five to seven stood on the lost portions. The bases of the crowns are circular. The external process of the bone is slender and flat.

The portion of the mandible preserved, includes much of the articular, and adherent parts of the angular. The latter forms a narrow band on the lower edge of the external face, and one twice as wide on the inner face. The only characteristic feature is the lowness of the ridge which descends and extends anteriorly from the anterior margin of the cotylus for the quadratum.

Of the vertebræ several are so distorted by pressure as to be uncharacteristic. Two well preserved anterior dorsals have transversely oval articular surfaces excavated openly above for the neural canal. One is from a position anterior to the other, and these surfaces are less oval, though still transverse. The centra of both are very concave in profile below, and expand both inferiorily and laterally to the edge of the cup. A deep groove surrounds the base of the posterior face. In the anterior dorsal the neural arch is preserved. It exhibits an approach to a zygosphen articulation more marked than in any other *Liodon*, and is hence nearer *Clidastes* in this respect as well as in the slender pterygoid. A zygosphen is not separated from the zygapophyses, owing to their connection by a lamina of bone. The notches at the posterior end of the arch for this prominence are marked. The neural spine had a long anterior ala, the base of which extends to the summit of the neural arch. It presents a fine striation vertical to the centrum and oblique to the edge of the bone, as is seen in *C. propython*, Cope. The diapophysis on this vertebra looks obliquely upwards and carries a vertical articular surface which is concave behind. The line of its lower extremity falls the depth of the neural arch below the latter, and of its upper reaches the apex of the canal in front. The more posterior vertebra has as usual a broader articular rib surface, the diapophysis being flattened above and below. The marginal and angular surfaces are striate-rugose on these and the other vertebræ. One of the free hypapophyses of a cervical is preserved. It has a subtrigonal section and is longer than wide, and obtuse. Its posterior faces are exceedingly rugose.

A cervical rib is compressed and short. Head narrow, large simple, the adjacent sides striate-rugose. Sides with a shallow groove.

The scapular arch is represented by an entire right scapula and proximal part of right coracoid. The former is broader than in any of the species in which I have seen it (four only), and is flat, and thin above. Its anterior extension is greatest below ; its posterior above, at the superior angle. The lower posterior margin is strongly concave and thickened. The antero-superior margin is a regularly convex arc of more than 180°. The lower portion in front is on a different plane, and is the rudimental acromion. The articular surface is rugose, and the glenoid cavity not less so.

The proximal portion of the coracoid is flat. It presents the usual foramen near the anterior margin, and the shorter concavity of the anterior margin leads to the belief that the anterior extremity of the bone is the more prolonged as in *Clidastes propython*.

The glenoid cavity is not concave, but merely two adjacent flattened rugose surfaces.

Consequently the *humerus* has no head, but merely an elongate articular surface, which exhibits a median keel and a short angular expansion near the middle. This bone is of remarkable form, more resembling that I have described in *Clidastes propython* * than any other, and very different from that described by Leidy in *Platecarpus tympaniticus*. It is a broad flat

* See Trans. Amer. Philos. Soc., 1869, 219. Tab. XII, fig. 17.

bone expanded at the extremities in one plane distally, so as to be as wide as long. In the present individual it is crushed by pressure, so that its thickness is not readily determinable. Its external surface rises into a crest medially at the narrowest portion, which continues to the lateral angle of the proximal end, following parallel to one of the borders. A moderate thickening exists on the opposite side a little beyond the extremity of the crest. Strongly rugose striæ extend to the edges of the articular faces. An oval rugose muscular insertion exists on the least prominent of the distal angles, and not on a process as in *C. propython*.

A bone which from its analogy to the *radius* of the last named species I suppose to be that bone, accompanies the others. It is flat, truncate proximally and with nearly parallel borders on the proximal half. Distally it is obliquely expanded, the outline forming a segment of an ellipse whose axis is oblique to that of the bone. Its extremities are rugose-striate.

One *carpal* remains: it is a quinquelateral bone, one side being marginal and concave. Perhaps it is the intermedial. There are several elements which are probably metacarpals. The general structure of the whole limb may be determined from these and from the numerous *phalanges*. The former are flattened and with oblique extremities; the latter more cylindric, with a transverse truncation. Both have a median contraction, which becomes less marked in the distal ones; these are also more cylindric, entirely so at the distal extremities, which are concave. All of these element are rod-like, much more slender than any of those figured by Cuvier or Leidy. Those immediately following the metacarpals are flattened, but thickened distally.

The number of *digits* cannot be readily determined, but four may be certainly distinguished. The general similarity in construction of the manus to that of a Cetacean mammal is noteworthy.

Measurements.	*M.*
Length suspensorium (anteriorly)	0.111
Width " medially	.031
Quadrate, greatest length	.099
" width of ala	.066
" thickness behind	.03
" length distal extremity	.043
Pterygoid, length six alveoli	.055
Anterior dorsal, length centrum	.059
" " width cup	.0515
" " depth "	.038
" " expanse poster. zygapophyses	.0395
" " " diapophyses	.091
" " width neural canal	.0135
" " depth "	.011
Posterior " " ball	.049
" " width "	.0425
" " length centrum	.0555
" " expanse diapophyses	.088

Scapula length	.145
" width proximal	.07
" " median	.112
Coracoid width, proximal	.066
Humerus length	.154
" width proximal	.119
" " median	.075
" " distal (restored from C. propython)	.158
Radius length	.115
" width proximal	.061
" " distal (oblique)	.105
Carpal length	.04
" width	.037
Metacarpal length	.095
" width proximally	.045
" " medially	.018
" " distally	.034
Phalange (medial) length	.085
" " width proximally	.027
" (distal) length	.059
" " width distally	.0082
Ramus mandibuli, depth in front of cotylus	.056
Cervical rib, length	.074

The total length of the anterior limb could not have been less than 0.90 M., which allows of five phalanges in the longest digit. There may have been more. That the digits were of unequal length is indicated by portions of two in matrix accompanying the specimens, where the articulation of two phalanges falls opposite the shaft of one of the adjoining digit. The phalanges were separated by a short interval of cartilage.

The size of this reptile was near that of L. validus, perhaps thirty-five to forty feet in length.

The affinities of this species as incidentally pointed out, are to those *Liodons* which approach *Clidastes*. This is indicated by the many pterygoid teeth, the rudimental zygosphen articulation, the regular striæ of the bones, and the forms of the limb bones. In Mosasaurus the humerus is shorter and the phalanges are longer.

The specimens on which this species rests were discovered by Prof. B. F. Mudge, formerly State Geologist of Kansas, now Professor of Geology in the State Agricultural College of Kansas, on the north bank of the Smoky Hill River, thirty miles east of Fort Wallace, Kansas.

Numerous fragments of another larger individual were found by Prof. Mudge near the same locality, which belong probably to the same species. Among them is a portion of the maxillary bone with bases of two teeth; the bases of the crowns where broken off are not compressed, but slightly oval. A radius is a flat bone, more dilated at one extremity than that of *Clidastes propython*.

	M
Length of radius	0.108
Width do. narrower extremity	.064
" " wider "	.08
" " medially	.042

This species cannot be confounded with the *L. proriger*, Cope, and *L. congrops*, Cope, owing to its depressed vertebral centra; from *L. mitchillii*, DeKay, the equal and numerous pterygoid teeth separate it at once.

LIODON MUDGEI, Cope.

I am not quite sure whether this species belongs to this genus or to Mosasaurus. The characters of its quadrate bone, size, &c., induce me to refer it provisionally to the former.

Its determination rests on a series of specimens from the yellow chalk at a point six miles south of Sheridan, Kansas. They consist of three vertebræ and fragments of atlas, with numerous portions of cranium and proximal extremity of scapula.

The parts of *cranium* preserved are the frontal bone without the anterior extremity, and with the adjacent parietal almost complete, parts of the basisphenoid, the suspensorium, the ossa quadrata, and the greater part of the articular. The frontal is flat with thin edge, longitudinally hollowed on each side of the median line, which is marked by a low but acute keel. There is an abundance of foramina and delicate grooves on the surface, and posteriorly elevated striæ, which converge to the median keel. The median square projection of the border of the parietal is in advance of the lateral portion of the same, and not behind it as in *Clidastes propython*. The fontanelle is large. A marked feature is that the parietal crests unite into a low median ridge a short distance behind the fontanelle and are not, as in *Clidastes propython*, separated by a horizontal plane. The sutures of the bones forming the side of the brain-case are very obscure. Nevertheless it appears that the descending margin of the parietal does not descend to the front of the alisphenoid, but is margined inferiorly by the latter to the postorbital expansion. No part of the inferior margin of the alisphenoid can reach the sphenoid, as it terminates in a thin edge except for a short distance medially where it is broken off.

The inferior aspect of the parietal and frontal bones presents a furcate keel corresponding to the divergent parietal crests, and a very large funnel for the epiphysis of the brain. The olfactory groove is deep and regular.

The *articular* bone is characterized by the prominent longitudinal crest which descends on the inner side, from the front of the glenoid cavity to below the posterior attachment of the coronoid bone, where it terminates in a thin edge. Also by the short distance between the margin of the glenoid cavity (cotylus) to commencement (or end) of coronoid suture, indicating a shortening of the posterior part, at least, of the cranium. The bone is continued forwards only immediately under the coronoid (cfr *L. ictericus*).

The proximal extremity of the *quadrate* is characteristic, and exhibits features intermediate between those of *Liodon ictericus*, Cope, and the typical species of Mosasaurus, as *M. fulciatus*, *M. dekayi*, &c. The proximal articular face is much like that of *M. depressus* (Trans. Amer. Philos. Soc., 1869, p. 181, Fig. 48, No. 3). The external angle is much smaller than in the Liodons and more anterior, nevertheless it is continued distally as a ridge-like angle separating the antero-lateral from the postero-lateral faces as in them, and not presenting the gradual blending of the two surfaces characteristic of the genus *Mosasaurus*. The postero-lateral face is thus flat proximally, and the meatal pit, which is well developed, cannot be seen from the antero-lateral face. The distal part of the quadrate is lost, so that I cannot determine the character of the ridges there.

The basal element of the axis bears a strong hypapophysis without articular faces, but very rugose surfaces. The same portion of the atlas is a convex parallelopipedon, with median rugose tuberosity and very rugose extremities. Its surface is not separated from its body anteriorly by a deep groove as in *L. ictericus*.

The articular facets of the *scapula* are much broader than in the other species here described, indicating a head or wider articulation of humerus. No limb bones were preserved.

The vertebræ are too much injured to be characteristic, with one exception. This one is a posterior dorsal, and had had compressed centrum, or at least not depressed. The inferior face is convex transversely, and there is a slight concavity below each diapophysis.

Measurements.	*M.*
Parietal, length	0.074
" width between anterior and crests	.048
" least width	.022
Frontal interorbital width	.092
Quadrate width above	.02
" length from pit to proximal end	.023
Articular, length lower edge	.015
" depth in front of cotylus	.35
" " at end coronoid	.055
Posterior dorsal length	.0495
Scapula proximal width	.051

This species differs from all those of *Mosasaurus* and *Liodon*, in which the form of the quadrate is known in the character of that bone. From L. lævis and L. congrops in which that element is unknown, it differs in the stouter or less slender vertebræ; from *L. proriger* in its much smaller size.

Its size is a little less than the *L. ictericus* or *L. validus*. It is dedicated to Professor Mudge, in recognition of the valuable results of his investigations as State Geologist of Kansas.

CLIDASTES CINERIARUM, Cope.

The largest species of this genus as indicated by the zygosphen articulation of the vertebræ.

The locality where it was found is the same as the last, but the specimens were taken from the gray bed, perhaps the same that produced the *Elasmosaurus platyurus*, Cope. They consist of vertebræ and pterygoid teeth. There are two anterior dorsals, three lumbars, and one caudal. The articular faces of the caudals are broad vertical ovals. They increase in width on the lumbars till on the last of these they assume the subpentagonal form characteristic of many species, and which is still more marked on the caudal. The centrum of the anterior dorsal is much compressed; inferiorly, slightly concave longitudinally, regularly and prominently convex transversely. Conversely, the rims of the cup and ball are strongly expanded, the latter with surrounding groove. The diapophyses of the lumbars are of considerable length, exceeding in this respect those of *Mosasaurus* we possess, where these parts are preserved. On the median of the lumbars the inferior surface of the centrum first becomes truncate or plane, and separated from that below the diapophyses, which become slightly concave. The expansion of the ball becomes more abrupt and striking on these vertebræ. The caudal is a little more compressed than the lumbars, and presents the character of coössified chevron bones. These are slender and longitudinally grooved.

A single pterygoid tooth was found in the matrix on one of the dorsals. The basis is short and much swollen; the crown curved, acute, a little compressed, and with an obtuse cutting edge posteriorly.

Measurements.

Vertebræ, &c, from brown bed.

	M.
Anterior dorsal, length centrum	0.0608
" " depth articular ball	.038
" " width " "	.038
" " diameter behind diapophyses	.029
" " depth articular face for rib	.022
Lumbar, length centrum	.06
" depth ball	.037
" width	.039
" length remnant of diapophysis	.046
" No. 2, length centrum	.055
" " width zygosphen	.0182
Caudal length centrum	.041
" depth cup	.04
" width	.04
" " basis diapophysis	.0245
" " between chevron rami	.0115
Pterygoid tooth height crown	.0125
" " diameter pedestal	.013

This species was found by Prof. Mudge near the locality of the *Liodon mudgei*, six miles south of Sheridan, Kansas.

It is only necessary to compare this species with *C. intermedius*, Leidy,* as the *C. iguanavus* and *C. propython* have depressed vertebral centra. Those of the first are rounded, of the present compressed. The C. intermedius also agrees with the two others in the obliquity of the articular faces to the vertical transverse plane of the centrum; in the present species these planes are *parallel*. This species is also larger than the *C. iguanavus*, Cope; the *C. intermedius* is smaller.

There is another species from New Jersey to which it is more nearly allied, a vertebra of which I have described under the head of *Liodon lævis* (Trans. Amer. Philos. Soc., 1869, 205), and figured l. c. Tab. V. fig. 5, under the erroneous name *Macrosaurus validus*. This probably does not belong to the *Liodon lævis*, which does not possess the zygosphen articulation but is most likely allied to the present species, and a true *Clidastes*. When compared with a vertebra from the same position in the column as determined by the position of the diapophyses, the articular faces are still more compressed, and the inferior surface of the centrum instead of being regularly convex, forms a plane separated from lateral concavities by an obtuse angle. There is less expansion of the margins of the cup and ball. The size is also greater. I propose to distinguish this species as *Clidastes antivalidus*, Cope. It is from the darker stratum of the green sand near Medford, New Jersey.

Obituary Notice of Samuel Vaughan Merrick, Esq., by Daniel R. Goodwin, D. D.

(*Read before the American Philosophical Society*, December 16, 1870.)

Mr. Samuel Vaughan Merrick, who died on the 18th of August last, was, at the time of his decease, among the oldest members of this Society. Elected in 1833, his membership covered more than the average period of a generation. His was a noiseless and unobtrusive, but an eminently active and beneficent life, moving on like the current of a deep and quiet river, silently depositing the accumulations of rich alluvium along its banks, and bearing the freighted wealth of thousands upon its bosom. He was not what is commonly recognized as a great or a distinguished man. His life does not stand out before us in bold relief, in marked individuality, leaving upon the mere casual observer the impression of its definite outline; but was buried and mingled in the moving and surging mass of the world around him. It might be thought fitting, therefore, to dismiss our notice of him in a few passing words; but to me there seem to be special reasons, in this very peculiarity of the case, for pursuing an opposite course; and I shall, therefore, ask the indulgence of the Society in giving a somewhat greater extension to this paper than is usual; though less, after all, than the subject, in my judgment, demands. Great usefulness was Mr.

* Proc. Acad. Nat. Sci., Phila., 1870, p. 4.

Merrick's distinction. Solidity, energy, practical sagacity, were his characteristics. In the wildly moving and fermenting mass with which his life was mixed up, it was ever a guiding and propelling element of progress, and a leavening element of good, but an element requiring some attention and study for its distinct apprehension and full appreciation. If we have more men of this kind of greatness than of the other, we have reason to rejoice in the fact. A community in which such men abound need never be ashamed, unless social improvement and happiness are occasions for humiliation.

This is a Philosophical Society; but we are not, and we need not all be philosophers in the narrower technical sense. He who leaves the world in a high degree better, wiser and happier, for his having lived in it, is either, in the large and more generous sense, a philosopher, or something more and better than a philosopher.

It is true, that classifications of men are always deficient in logical precision. They express only leading tendencies or marked degrees. But one of the most general, and, at the same time, most simple and fruitful in its applications, is the two-fold division into men of *thought* and men of *action*. But these two classes are not to be kept aloof from each other, still less to be arrayed in mutual conflict. They are reciprocally complementary and helpful. One aim of this Society is, to aid in bringing them into their appropriate relation to each other. And few among us have labored more successfully for the accomplishment of this end, or have presented in themselves a better illustration of the happy union of these two characters, than Mr. Merrick. To suppose that this Society was designed to embrace only men of mere thought, that it confines its mission to mere speculation or pure science, is a great mistake. Its aim is eminently practical. It seeks thought, scientific observation, certainly; but it seeks thought only as related to its applications. It would utilize thought, and it would rationalize action. It would reduce action under the stimulus and guidance of thought; and it would provoke thought to its intensest and, at the same time, its most healthful exertion on the field of action. This Society is not the arena of combat, but the armory and *foyer* of the combatants; it is not the theatre of action, but the *post-scenium* of the actors. It seeks to bring thought into its widest play as well as its fullest development. It aims to make thought permeate and leaven the mass. Not only do we, therefore, welcome men of action rising into the sphere of thought, but we admire and cheer on men of thought descending into the dust and struggle of action. The dignity of labor is the true dignity of man. To enforce this truth is one of the highest aims of this Society. The elevation of man is the noblest end of philosophy.

It is in this view that Mr. Merrick's career presents itself in its true significance, and in its proper relations to this Society.

This will best appear from a rapid sketch of his life and character.

Mr. Merrick was born at Hallowell, Maine, on the 4th of May, 1801. His father, John Merrick, was a man of marked character, and extraordinary mental vigor. In 1798 he came to this country from England, where he

had been educated for the Unitarian pulpit. Not finding in this his vocation, he lived in Hallowell as a gentleman of retired leisure, or rather, of great and varied and beneficent activity. The mother was a daughter of Samuel Vaughan, Esq., a merchant of London. His brother, John Vaughan, uncle of our Samuel Vaughan Merrick, was, for a long series of years, identified with this Society, as its Librarian and Secretary. He is remembered with affectionate respect for his genial social qualities, and for his rare benevolence and kindness of heart. He cared for the stranger. Every foreigner, of whatever nationality, who chanced to be in Philadelphia, found in him more than the official consul of his country,—a sympathizing friend.

In his uncle's business house, our S. V. Merrick was placed at the age of 15, to be trained as a wine merchant. At the age of 19, a proposition was made to him to leave that business, and enter an opening which presented itself for the manufacture of machinery. This was to exchange the profession of the merchant for that of the mechanic,—a step which it is significant to observe was at that day regarded as involving little less than social degradation. Young Merrick, in the full determination to hew his own way in the world, accepted the offer, doffed his coat, and rolled up his sleeves to the work. The firm of Merrick & Agnew was established; and soon gained unusual celebrity as manufacturers of improved Fire-engines. Professors in New England colleges used to exhibit these engines to their classes as illustrations in mechanics and specimens of American ingenuity and workmanship.*

Young Merrick rapidly developed, under his own teaching, a remarkable engineering and mechanical talent.

After some years he was ready to enlarge his field of operations; the "Southwark Foundry" was established; the firm of "Merrick and Towne" was founded in 1837, and entered into the general and extensive manufacture of various kinds of machinery and apparatus, particularly of steam engines and boilers. As an illustration of the energy and enterprise of the firm may be mentioned the fact, that, at so early a period and in the infancy of mechanical engineering in this country, they contracted for and constructed the engines of the U. S. Steam frigate Mississippi, which proved to be one of the speediest, safest, most trustworthy and serviceable ships in the navy. It was chiefly due to the faithfulness, skill, and perfect finish with which her machinery was constructed, that abroad, as well as at home, she became an object of national pride. In her Commodore Perry made his visit to Japan and rode out the cyclones of the China sea; and she continued high in the list for effective service, until, on the night of the 14th of March, 1863, she ran aground and was blown up under the guns of Port Hudson.

In 1849 Mr. Towne retired from the firm, which was continued under the

*Later in life, Mr. Merrick retained his early interest in the improvement of Fire Engines, although they were no longer manufactured at his works; and for many years he took personally an active and leading part in the Fire Department, until he secured the introduction of the Steam Fire Engines throughout the city.

well-known style of "Merrick and Son," and "Merrick and Sons," although Mr. Merrick's active connection with it ceased from the year 1860. The development of this great business establishment was the main work of his life, and he persevered in it for a period of near a quarter of a century. He retired from it with large wealth honorably acquired in a business whose great private gains were conditioned upon conferring immensely greater public benefits; in works and enterprises which sensibly contributed to the growth and prosperity of the city and to the welfare of the state. He retired when the establishment which he had reared was still in the flood tide of success, for it was never more active or useful than during the years of the late rebellion.

At an early period in his career, Mr. Merrick became deeply impressed with the importance to mechanics, for their success and elevation, of more thought and intelligence, of more acquaintance with the progress of mechanical arts and inventions, and of more of mutual intercourse and social stimulus. With this view he projected and urged forward the establishment of the Franklin Institute; and it may be said, I think, without disparagement to the claims of any other of its original members, that no man has a better title to be considered its *founder* than Mr. Merrick. For a long series of years he continued one of its most active and honored members; until, from its small and unpretentious beginnings, as little more than an association of mechanics for mutual improvement, it was developed into the chief centre of practical science in the city, became an honor to Philadelphia, and enjoyed a familiar national and European reputation.

In one point of view the Franklin Institute has taken as its specialty and almost absorbed into itself one portion of the work which pertains to the general scope of this Society. Among our own founders was Benjamin Franklin himself, a most thorough utilitarian, who always regarded science with an eye to its practical applications, and considered them among the principal motives for all scientific effort and enquiry. And, in general, so far as the founders of this Society were philosophers, they were eminently Socratic philosophers; and such is the philosophy which they designed the Society they established always to represent. The Franklin Institute may, therefore, be considered as an offshoot, or a department, or a section—not in form but in fact—of the American Philosophical Society. And this may explain why, in later years, Mr. Merrick may seem to have relinquished his active participation in our work—it was because his interest and energies were absorbed in the Franklin Institute.

The Managers of the Institute have expressed their own sense of the merits and character of Mr. Merrick, in the resolutions which are here subjoined:

"*Resolved*, That the Managers of the Franklin Institute have received with the deepest sorrow the announcement of the death of Samuel V. Merrick, the founder of the Institute, for many years its president, and always its earnest, liberal and devoted friend. Associated with it as he was in its early efforts for the public confidence and support; participating as he did in all the great labors and enterprises by which it

won its way to the honorable reputation it now enjoys; his name and character are so mingled with its history that, while the Institute endures, his will be an enduring memory.

"*Resolved*, That the Managers of the Institute, many of whom have been for years associated with the deceased in the care of its affairs, and in the other walks of life, in which he was so distinguished for broad and wise intelligence, for untiring zeal, and for great public spirit, will ever cherish with feelings of proud and affectionate remembrance, the kindly and honorable associations which have always distinguished his relations with them.

"*Resolved*, That, in token of our sense of the loss we have sustained, the Hall of the Institute be closed on Monday next; that the Managers attend his funeral in a body, and that the members of the Institute be invited to join with them in paying the last earthly tribute of respect to their honored associate and friend."

To Mr. Merrick before all others, the City owes the introduction of gas as a means of illumination, instead of the oil formerly relied upon for the purpose—a reliance so precarious, inefficient, clumsy, filthy and expensive, that we all, as we look back, should now feel its restoration emphatically a return to the Dark Ages. Not so did the case look from the other end of the glass. Mr. Merrick, with his characteristic, practical sagacity, early saw the advantages of substituting gas for the material formerly employed; and he perseveringly urged its substitution, amidst an extraordinary excitement of public feeling, and a most earnest and confident opposition on the part of some of the most respectable and intelligent of his fellow citizens—an opposition which we now regard with wonder, and which those who participated in it remember as a strange dream. We see things now in a different light; and it is difficult for us to place ourselves at the point of view from which the subject was then contemplated; yet it is only by so doing that we can duly appreciate the prophetic vision and indomitable energy of those who persevered for years in urging on, step by step, the proposed improvement.

Mr. Merrick sought and obtained a seat in the City Councils, that there he might labor directly to secure the change. He was appointed Chairman of a Committee of the Common Council, which, after corresponding with the authorities of the few other cities in this country where gas had been partially introduced, reported with a full and triumphant answer to all the objections which had been urged against it. To his great satisfaction, he subsequently received an appointment from the Councils to visit England and parts of Europe, for the purpose of inquiring into the facts connected with the use of illuminating gas in those countries.

On his return, in 1834, he made a full report, which was marked by great wisdom and ability. Whereupon it was resolved that the experiment should be tried in Philadelphia. Mr. Merrick was appointed, as chief engineer, to take charge of the erection of the works, of the manufacture of the gas, and of the whole business of introducing and distributing it in the city. This task he performed without the least waste, failure, mistake, or delay, but with singular economy, skill, and promptitude, to entire and universal public satisfaction. On the 8th of February, 1836, the lamps were lighted; and in their next annual report the Trustees of the Gas Works render the following emphatic testimony:

"The works are built in the most substantial manner, and, for the perfection and economy of their operation, are certainly unrivalled in this country; the rapidity with which they were constructed and the complete adaptation of every part of the apparatus to its intended purpose, reflect the highest credit on the engineer, Samuel V. Merrick, Esq., whose faithfulness and ability in discharging the arduous and novel duties of this undertaking, it gives us much pleasure thus publicly to notice."

In their report of the year following they say:

"In conclusion the Trustees have to state that Samuel V. Merrick, Esq., the able engineer who constructed the first section of the works, having found that his continued attention to them interfered too much with his private engagements, tendered his resignation, which the Board reluctantly accepted on the 8th of February, 1837. As the extensions were about to be made, the trustees requested Mr. Merrick to devote occasionally, to a general superintendence of the new works, so much of his time as he should be able to spare, or as might be deemed necessary, in consultation with the superintendent. This duty has been performed to their utmost satisfaction, and the trustees can only repeat here their unqualified approbation of the conduct of that gentleman, and their admiration for the signal success which has attended the works put up by him."

At a meeting of the Stockholders held in the ensuing week, it was resolved:

"That the trustees be hereby authorized to appropriate the sum of $600 to be expended in the purchase of one or more pieces of plate; to bear such inscription expressive of the approbation of the Stockholders as they may think proper; to be presented to Samuel V. Merrick, Esq."

Nothing is more striking in all Mr. Merrick's connection with this business than the largeness of his views for the general good, and the unselfish public spirit which marked all his labors. He sought to promote the comfort and convenience of his fellow citizens, and permanently to diminish the burden of taxation. He sought also to develop the resources and industrial wealth of the State. In his report on his return from Europe are these noteworthy words: "I deem it an argument of no small moment in favor of this mode of lighting, that every material used in the fabrication of this gas will be the product of Pennsylvania labor. The bituminous coal from which it is to be made, may be drawn from the rich mines now open in the interior of the State; the fuel, from the exhaustless body of anthracite; and the lime for purification, from our own vicinity; and not a lamp will shed its rays over our streets which has not paid a tribute to the internal improvements of the State."

In like manner, it was distinctly as a public benefactor, it was from a sensitive regard for the welfare and prosperity of the city and State of his adoption, that, some ten years later, Mr. Merrick led off in another great enterprise. He was one of the prime movers in the establishment of the Pennsylvania Central Railroad Company, and was its first President. The books were opened for subscription to its stock in 1846, and its

President made his first report in 1847. This document contains a clear and business like statement of the means of the Company, and of the plans for their immediate use. And not only so, it wisely suggests and urges their increase, also without incurring any debt,—the avoidance of which was a fixed principle in all his administrative arrangements; and it sets forth such far reaching views of future growth and enlargement that it looks almost like history written before the time.

His motives for throwing himself into this enterprise, and the motives upon which he invited others to participate in it, appear in his report addressed to the stockholders in September of the next year (1848), in which he earnestly urges them to increase their subscriptions. "The absolute necessity," says he, "of this road to the trade of Philadelphia is universally acknowledged. The completion of the Cincinnati and Sandusky road brings that city within three days ride of New York for eight months in the year.

"The trade of the Ohio river, which once belonged to Philadelphia, is now diverted to New York by this new channel of the lakes.

"Hundreds of passengers daily pass over that road to New York. Where the travel goes, there goes the trade. * * * *

"You are engaged in a great struggle for the trade of the West. To obtain it a portion of your earnings must be devoted to open the highway. Once open, it will maintain and enlarge itself. Railroads and Canals have built up New York; and so well convinced are the citizens of their value, that they are now making a third avenue to the lakes, both the others being crowded with trade.

"Boston has been built up by the same means, and if we expect to maintain our position, we must follow their example."

In fact even Baltimore had got the start of Philadelphia; and if the Pennsylvania Central had not been opened just when it was, not only the trade of Ohio and the far West, but even that of the western part of our own State would have been irretrievably diverted to Baltimore, on the one side, and New York on the other.

Such were the circumstances and motives under which this great work was undertaken. When Mr. Merrick, again compelled by the pressure of his own private business, retired from the Presidency, Sept. 1, 1849, the road was opened for travel from Harrisburg to Lewistown, and nearly completed to the base of the Alleghanies, the western division was begun, and a small portion in use, the whole route was surveyed and the cost of construction estimated, and negotiations had been successfully concluded for connection with the cities of Ohio and with the avenues of the more distant West. The Board of Directors in the following November, thus refer to Mr. Merrick in closing their report:

"The distinguished gentleman who had, with signal ability, administered the affairs of the company from the date of its organization, was constrained, by reasons altogether personal and private, to tender his resignation in August last, and it was reluctantly accepted by the Board.

His continuance as a Director ensure to the Company the benefit of his enlarged experience, sound judgment, and thorough acquaintance with the work.*

Thus the foundations of the great edifice were laid, and the plans and materials provided for the superstructure. The seed was planted, and had germinated; it had shot up its trunk, and was already beginning to send out its wide-spreading branches. The Pennsylvania Railroad Company is now one of the greatest and most powerful corporations in the country, with a gross annual income exceeding the original estimated cost of the construction of its entire original track from Harrisburg to Pittsburgh. It is by far the most important and indispensable business agency of Philadelphia and of Pennsylvania. Strike it out of existence, and the city would be stunned by the blow, and even the State would stagger under it. It is an immense power for good or for evil. But whatever motives may actuate its present or future managers, and however its influence may be abused or its energies perverted, we have this security that it cannot be made profitable to its owners without continually benefiting the community. And by whatever motives or principles its action may hereafter be controlled, "the past, at least, is secure;" its projectors and originators were actuated by a generous devotion to the public good, they sought to promote the prosperity of the city and the growth and development of this great commonwealth. As one of its founders, and as its first President, Mr. Merrick's name is identified with its whole history. He shares the glory of its subsequent greatness, while it inherits the prestige of his noble purpose and character.

When, after nearly another decade, an effort was made to construct a Railroad from Sunbury to Erie, thus completing the connection between Philadelphia and the lakes, through the great western coal fields of Pennsylvania; and when, after many ineffectual struggles, the enterprise threatened to prove a disastrous failure, all eyes were turned to Mr. Merrick. He was recognized as the only man in the community who

* The following is Mr. Merrick's letter of resignation:

"OFFICE PENNA. R. R. CO., PHILADA, Aug. 22, 1849.

"To the Directors of the Penna. R. R. Co.

"GENTLEMEN:—Circumstances connected with my private affairs compel me to announce to you my intention of resigning the office with which you have entrusted me.

"I need scarcely say that I take this step with great reluctance.

"Identified as I am in feeling and interest with the great work which, above all others, is destined to add to the prosperity of Philadelphia, I had hoped to have been prominently instrumental in urging it to final completion; and although I relinquish the position I have occupied as the President of the Company, my exertions will not be wanting in forwarding its interests.

"It is no small cause of regret that my official connection is severed with gentlemen, both of the Board and in the office, with whom I have acted in the most uninterrupted harmony and good feeling, a continuation of which it will always be my pleasure to cultivate.

"Desirous of resuming my private business at as early a date as possible, and at the same time give an opportunity to select a successor, I leave to the Board to fix the date at which my resignation shall take effect.

"Very respectfully,

"S. V. MERRICK,

"President Penna. R. R. Co."

could retrieve its affairs, and push it on to speedy success. Early in 1865 the Presidency of this road was offered him, and urged upon his acceptance. He was upon the point of declining it when the following letter was addressed to him, which, with its signatures, speaks for itself, and for him also.

"PHILADELPHIA, Feb. 21st, 1856.

"To SAMUEL V. MERRICK, ESQ.:

"Dear Sir: We have learned that the Presidency of the Sunbury and Erie Railroad Company has been tendered to you, under such circumstances as render it reasonably certain that your character and ability may conduct that enterprise to a successful completion.

"We are sensible that such a position cannot present any peculiar attractions, but that any favorable consideration you may give to the application would have its origin in a high sense of public duty.

"There are occasions when purely personal motives ought properly to yield to public claims, and in the exigency which calls for an efficient and tried man to administer the affairs of the important work above named, we may well address ourselves to you to assume the Presidency. Your perfect organization and successful administration of the affairs of the Pennsylvania Railroad Company are so well remembered by our fellow citizens, that we are sure the whole community would hail with pleasure your acceptance of the proffered trust.

"We feel confident that you can organize an administration and adopt financial and other plans, which will at once place the Sunbury and Erie Railroad in its proper attitude before the people, and insure such aid from public and private sources as will realize an early completion of a work that must open for the trade of our city one of the richest agricultural and mineral districts of the State.

"On behalf of the great interests involved, we call on you to accept the office.

We are very truly and respectfully yours,

JOHN GRIGG,	C. H. FISHER,
THOMAS ROBINS,	THOS. T. LEA,
WM. E. BOWEN,	S. A. MERCER,
ISAAC R. DAVIS,	F. FRALEY,
ALG'N S. ROBERTS,	C. S. BOKER,
A. E. BORIE,	S. F. SMITH,
FRED'K LENNIG,	C. H. ROGERS,
JAMES C. HAND,	JOS. PATTERSON,
A. J. LEWIS,	JOHN FARNUM,
MORRIS L. HALLOWELL,	J. RICHARDSON,

THOMAS ALLIBONE."

To such an appeal to his sense of public duty Mr. Merrick could not turn a deaf ear.

The following was his reply:

"PHILADELPHIA, Feb. 23d, 1856.

"GENTLEMEN: I was duly honored with your letter of the 21st inst., urging my acceptance of the Presidency of the Sunbury and Erie Railroad Company. The peculiar circumstances in which that work had recently been placed, gave a weight to the application made to me, which was well calculated to overcome all considerations but those of public duty. Without, however, the expression of such a wish on the part of my fellow citizens, as indicated in your letter, I should have felt constrained to decline the offer; but the reasons urged by you, in addition to those presented by the gentlemen who tendered the appointment, caused me to yield a reluctant assent.

* * * * * * * * *

"Accepting this trust at your solicitation, as representatives of the public feeling and interests of the city, and relying upon your co-operation, I remain,

Very truly and respectfully,

S. V. MERRICK."

Mr. Merrick began at once with an energetic reformation and remodeling of the whole organization and administration of the road. But scarcely had he addressed himself to the Herculean task, when the terrible commercial crisis of 1857 swept over the country, prostrating even many old establishments, and utterly paralyzing new enterprises, completely thwarting all plans for securing aid, public or private, arresting the progress of the road, and bringing the Company to the verge of bankruptcy. In fact, it was saved only by large advances from Mr. Merrick's own private resources—advances equally difficult and dangerous for a business man at that time to make. At the risk of ruining himself, and by almost superhuman efforts, he carried the Company through the storm. His own health was prostrated; and, after remaining in the Presidency nearly two years—as long, in fact, as he had ever anticipated being able to continue in it—he sent in the following letter of resignation:

"*To the Board of Managers of the Sunbury and Erie Railroad Company:*

Gentlemen: I have long contemplated declining a reëlection to the post of President of this Company in February next, as it interferes too much with my own affairs to warrant further continuance. Believing that the interests of the Company will be promoted by the immediate election of some other gentleman who will devote himself to the important interests at stake, I beg leave to tender my resignation.

* * * * * * * * *

The field is now open for an energetic prosecution of the work as soon as the returning tide of prosperity shall have fairly set in upon the commerce of the country, and I may indulge the hope that a brighter day may soon dawn on the Sunbury and Erie Railroad.

With every wish for the final success of the enterprise, I remain, very respectfully,

S. V. MERRICK, *President.*"

The road was soon after completed, and its bonds, that were issued with Mr. Merrick's name, have long been at par.

Nor did his labors in the cause of the public improvements of the State, and for the enlargement of the business and prosperity of Philadelphia end here. To his vigorous and wise counsels it has been, in a large degree, due, that the affairs of the Catawissa Railroad have been retrieved from a condition of imminent ruin. The road owes it to him that it now rests upon a solid basis, and has a promise of permanent prosperity and usefulness. The regard in which he was held by the Managers of that road will appear from the resolution adopted by them on the occasion of his decease.

"The death of our late associate, Samuel V. Merrick, Esq., who for fourteen years has been a Director of this Company, the value of whose counsel all appreciated, has been announced to us so unexpectedly, in the midst of current business, in which his energies were actively engaged, that we fail to realize the extent of our loss.

"The character of Mr. Merrick needs no eulogy at our hands; his long and useful life has been spent in 'good works.' The mention of his name in connection with any enterprise has always inspired confidence and respect. In relation to this Company, the interest of which appeared to be his special pride—through the period of its darkest history, he always manifested a cheerful confidence that time and energy would relieve it of all difficulties; and we rejoice that he lived to see his prediction verified."

In the eleemosynary institutions of the City, Mr. Merrick took a deep and active interest, and particularly in anything that promised to help the poor and weak to help themselves. He was among the founders, and most efficient managers of the Western Savings Fund; and to him is largely due the safe and solid character of this beneficial institution. Its Managers have given expression to their deep sense of his wisdom and worth in the following testimonial:

"*Resolved*, That it is with profound sorrow the Managers of the Western Savings Fund Society record the unexpected demise of SAMUEL V. MERRICK.

"By this sad memorial they will perpetuate the recollection of a man associated with the Institution from its foundation, who was distinguished by remarkable traits of character, that rendered him eminently useful to the world, and made him universally honored in every position he was called to fill. Wise in council, broad and comprehensive in his views, liberal and good in his deeds, and, above all, crowned with the possession of a truly Christian and Catholic spirit, his loss to society, and especially to his friends, will be long and keenly felt."

At the time of his decease, Mr. Merrick, besides an active connection with many other of the public corporations, and most of the leading charities of the city, was a prominent member of the Board of Trade, one of the Port Wardens of Philadelphia, and a member of the Board of Commissioners for the erection of the South Street Bridge.

Immediately upon his demise, the following expression was adopted by the last mentioned body:

"WHEREAS, This Board, and the City of Philadelphia, have suffered a great loss by the death of our colleague,

MR. SAMUEL V. MERRICK,

who for many years devoted his abilities, services and time, in promoting the interests of the municipal, charitable and scientific institutions of Philadelphia.

Resolved, That the President be requested to communicate to Mr. Merrick's family our sympathy and condolence in their affliction."

But neither Philadelphia nor Pennsylvania bounded his sympathy and public spirit, or his ideas of loyalty and patriotism. His heart embraced the whole country. He loved her flag. He was devotedly attached to her Union. When that flag was assailed, and that Union imperilled, his soul was stirred to its lowest depths. All conservative as he was in principle and feeling, he gave his full support to the Government through all the changing fortunes of the dark struggle, until the rebellion was suppressed. In the work of the Sanitary Commission he took a special interest, not only contributing freely to its funds, but rendering his personal services, at the time of the Great Central Fair, until his health was seriously endangered.

After the war, his attention was particularly drawn to the cause of general education at the South; and he gave large sums for the support of schools in that part of the country, both for blacks and whites. At the suggestion of a younger sister, he joined forces with her and his brother, and they, with their own independent funds, have built a commodious school house of brick, and established a school for the instruction of the negroes, in one of the counties in Virginia.

In fact, his benefactions have been more and larger than will ever be generally known; and always bestowed in a spirit of glad liberality, and with a modest unconsciousness of doing anything more than a matter of course. In this feeling he resorted to no artificial contrivances to hide his gifts; still less did he ever seek to have them bruited abroad. Cases have come to light in which an applicant, in behalf of some scheme of benevolence, after having explained the object, has hoped for a hundred or two dollars at the most, and been surprised by receiving from him a check for ten times that amount. Other cases of his giving by thousands have been known only in the circle of his own family, and to them only after a time and, as it were, by accident—in such a way, in short, as to indicate that these were but specimens of many similar cases of which his intimate friends knew nothing. It was a saying of Sir Isaac Newton, that "those who give nothing before their death, never in fact give at all." On this principle Mr. Merrick acted. He gave while he lived, and left it to his heirs to follow his example after he was dead. And surely the living spring, with its perennial flow, is better than the sudden inundation from any pent-up reservoir.

Mr. Merrick was a consistent Christian. In this relation, also, his *active* benevolence, so characteristic of him, could not fail to display itself. At the time of his death he was one of the Wardens of Grace Church, of which he had been a member nearly thirty years. In the erection and endowment of the Episcopal Hospital, he manifested a lively and practical interest; and to him, more than to any other man, the Diocese of Pennsylvania is indebted for its Episcopal residence.

Mr. Merrick's was an eminently successful life. He was always equal to what he undertook, to every occasion and to every position in which Providence placed him. He sought to raise others with himself. He respected labor, and he dignified it. Few men have done more to elevate

the mechanic to a higher intelligence and a more respectable social position. There have been men who have amassed millions, and who have not failed to give generously of their abundance when it could be done with great éclat; but who had, nevertheless, either grown rich at the expense of their neighbors, as mere gambling speculators, or been loose in their principles of integrity, or excessively parsimonious in their personal habits, or hard and rigorous to the last cent in all their daily transactions, especially with their dependents, employés, and clerks. Not so with Mr. Merrick. He expended freely as he went; he was generous and kind to all his dependents; in raising himself he lifted up others; their rising was the very mode and condition of his; all his operatives respected and loved him; all his business transactions were for the mutual benefit of the parties concerned; all his prosperity was the prosperity of those around him, and of the city in which he lived.

It is no small achievement thus to acquire a large property—by honest industry, by extraordinary skill, and tact, and enterprise, without parsimony, or stint, or exaction, but in the spirit and constant exercise of a large liberality. Indeed, this is one of the grandest schemes of benevolence and philanthropy that a man can conceive and carry out.

It implies a certain greatness of mind, a certain self-containedness, voluntarily to stop in the career of acquisition and leave the field to others.

It is no slight mark of the eminence and worth of any man that, at his decease, he should leave a sensible gap *in a great city*, that his departure should be widely felt as a public bereavement.

Every gas-burning lamp that lights our streets, our halls and our parlors, is a perpetual illumination of the name of Merrick. Merrick and Franklin, both sons of New England, will remain indissolubly associated as long as our Franklin Institute retains its name and remembers its founder. The great railways converging upon Philadelphia will be avenues and radiants for the enduring fame of the citizen who planned, and early presided over, the Pennsylvania Road, which has become the head of the great family, and now stretches its arms over a continent. His fire engines were long since eloquent with his name in many a city and village of the land; the beautiful frigate Mississippi bore it proudly around the globe; and later, in our great national life struggle, the same name reverberated along the rebel coast with the guns of our best and mightiest armored steamship of war.*

To sum up the character of our departed friend: He was a man of quick perception, of clear intelligence, of singular forecast, of large and liberal views, of rare sagacity, of imperious, even overbearing, will, and of indomitable energy; a just man, of honorable sentiments, of strict integrity, to be trusted anywhere and in anything, faithful in the least and in the greatest alike; a man of a kindly nature, of ready sympathy, instinctively and on principle benevolent, always benevolent—his benevolence

* The New Ironsides was furnished to the Government, hull, armor, and machinery, by "Merrick & Sons."

was not stinted by increasing years or increasing wealth, but grew rather with his means and his habit of exercising it; a man of ardent patriotism, he identified his own life with that of his country; of an ever generous and ready public spirit, he was in all relations a good citizen; religious, not without profession, but without cant, and beneficent without ostentation; his character, like his person, was of a noble and massive rather than of a graceful make. He was every inch a man.

And now, should it be thought that I have but followed the example of all manufacturers of obituaries, dealing only in loose and empty panegyric, I do not plead guilty to the charge. What has been said rather falls short of the truth than transgresses it.

If it be suggested that, after all, this certainly cannot be so very extraordinary a case, that Mr. Merrick was not so very great or remarkable a man, for we have among us every day many men quite as great, as good, and as useful as he, I cannot by any means concur in the suggestion; and yet I do believe, and rejoice to believe, that we have more good, earnest, public spirited, sagacious and energetic men, quietly working on among us, than we are sometimes, in our habitual querulousness, disposed to acknowledge. Amidst all our complaints, often unreasoning and inconsiderate complaints, of the degeneracy and corruption of the times, there is more of real greatness and goodness around us than we are aware of. Great and good men have not all passed away with the former generations. They are with us still. And it is one of the lessons we may learn from a review of such a life as Mr. Merrick's, to see and recognise the treasures we possess. If we have many such men as Mr. Merrick, let us rejoice; let us so look to them while they live, and so remember them when they are gone, that by all means we may have more.

An *Obituary Notice* of Franklin Peale:

Read before the American Philosophical Society, December 16th, 1870, by Robert Patterson.

At the meeting of the American Philosophical Society, held February 19th, 1796, the proceedings were diversified by a singular incident, which we find thus recorded in the minutes:

"Mr. Peale presented to the Society a young son of four months and four days old, being the first child born in the Philosophical Hall, and requested that the Society would give him a name. On which, the Society unanimously agreed that, after the name of the chief founder and late President of the Society he should be named Franklin." Tradition adds, that the infant was thereupon so named in the President's chair, given to the Society by Benjamin Franklin.

This child, in a peculiar sense the child of the Society, was Franklin Peale, our late associate, to whose memory I now, honored by your choice, seek to render a feeble tribute.

The father of Franklin Peale was Charles Wilson Peale, a man of various gifts, but eminent as a painter, and as the founder of the once

noted Philadelphia Museum. To him the country owes an extensive series of portraits of the most distinguished men of our revolutionary and post-revolutionary era. In the course of his profession, having been called on to make drawings of bones of the mammoth, his attention became attracted to natural history, and he began the accumulation of objects illustrating that department of science.* From very small beginnings, Wilson Peale, by energy, enthusiasm and self-sacrifice above all praise, succeeded in building up the Museum referred to, which Philadelphians of a past generation recall as one of the most interesting and useful institutions of our city. He was a member of our Society—which was naturally much interested in the success of his work—whence it happened that, while the Museum was still in its early stage of growth, in the year 1794, it was located in our building, the same which we now occupy; and here, in the northwest room, second story, now known as the Librarian's room, FRANKLIN PEALE was born, on the 15th day of October, 1795. His mother was Elizabeth De Peyster, second wife of Charles Wilson Peale. She died while he was quite young, but his childhood and youth were tenderly cared for by a stepmother, Wilson Peale's third wife, a member of the Society of Friends.

The father's views on the subject of education were peculiar. The children were not directed according to any systematic routine, but left much to their own choice in their course of study. They were guided according to a fancied ability, and means were furnished (but not always the teachers) to stimulate them to the acquisition of the knowledge towards which their minds seemed naturally bent. Books, tools, canvas, and pencils, besides the opportunities to see what had been done by others, he thought sufficient, provided there was a disposition to learn; otherwise he considered any attempt to push them forward as but lost time. If such a plan of education seems open to criticism, it may, perhaps, be justified by the result, which has furnished to us, in the Peale family, Rembrandt, the artist; Franklin, the mechanician; and Titian, the naturalist.

The instruction received by Mr. Peale seems, therefore, to have been quite irregular. He had no systematic course of training, either in school or college. He went first to a country school in Bucks County, was a short time at the University of Pennsylvania, and finished his education at the Academy in Germantown, where the family then resided.

The bent of Mr. Peale's genius towards mechanics was developed at a very early period. While quite young, he became distinguished as a manufacturer of all the usual apparatus for games, and many curious toys. As a school boy, he demonstrated a fondness for surveying as well as mechanics—in the interval of school hours surveying his father's farm near Germantown, and developing also the water power of some neighboring streams.

* I may be pardoned, I trust, the mention of the fact, since it illustrates a family friendship, extending now through several generations, that the first article presented to Mr. Peale, and the earliest encouragement of his project, was from Robert Patterson, a former President of the Society, and the grandfather of the writer.

At the age of 17, he entered the factory of Hodgson & Bro., on the Brandywine, Delaware, to learn machine making. From his industry, patience and neatness, he rose superior to his teachers. He became skilful as a turner and founder, and in the use of tools, and a very excellent draftsman. He here prepared the working drawings for the machines required for a cotton factory at Germantown, and had them constructed under his supervision, and in great part by his personal skill and labor. When barely 19 he left Delaware to take charge of the cotton factory just mentioned, of which he had the management for several years. He afterwards removed to Philadelphia, and entered into the establishment of John & Coleman Sellers, making machinery for card sticking.

Mr. Peale now separated himself for a time from the strict line of his profession, and entered upon the management of his father's Museum. For this duty he was well fitted, on account of his administrative abilities, his taste, and his talent for arrangement, as well as by a competent knowledge of the subjects to which it was devoted. The Museum was something more than a place of deposit for birds, beasts and fishes, but was a collection of curiosities in art, in mechanism, and in antiquity. Mr. Peale, in the pursuit of his own profession, had not neglected other fields of knowledge. He was ever an ardent student and observer. It was not likely, therefore, that he should have been unlearned in any of the subjects which the Museum was intended to illustrate, and which he had heard discussed from his childhood. While not professing a particular fondness for natural history, he so far mastered the subject as to deliver lectures upon it, availing himself of the special facilities placed at his disposal. His mechanical genius, also, found room for display, in adding to the curiosities of the establishment. Many of us will remember his curious speaking toy, besides other ingenious inventions which cannot now be specified.

It was while engaged at the Museum that Mr. Peale placed there a miniature locomotive, the first seen in this country, and manufactured by his friend, M. W. Baldwin, on a plan agreed on between Mr. Peale and himself. It was put in operation on a track, making the circuit of the Arcade, in which the Museum then was, drawing two miniature cars, with seats for four passengers. The valuable aid of Mr. Peale was afterwards given to Mr. Baldwin in the construction of the locomotive for the Philadelphia and Germantown R. R., in 1832, the success of which led to the establishment of Mr. Baldwin in the great business of his life.

Mr. Peale's position at the Museum was of advantage in bringing his peculiar and varied talents more conspicuously before the public. The establishment was largely visited, often by distinguished men of our own and other cities, and many learned to admire the ingenious young manager. His society and friendship were sought after, and he assumed his proper place as one of the select band then most active among us in the pursuit of science and art.

The Franklin Institute, then young and earnest, as it still is in the advancement of knowledge, secured the services of Mr. Peale for a series of

lectures on a subject adapted to his special talents. He here delivered two courses, in the winter of 1831-2 and 1832-3, on Mechanics, or rather on Machines. These were fully illustrated either by the machines themselves, or diagrams, were novel in their character, and justly added to Mr. Peale's reputation. He was long an active member of the Institute, giving efficient labor on its most important committees, and at the annual exhibitions, and occasionally contributing articles on mechanical subjects to its Journal.

In 1833, Mr. Peale entered upon that connection with the Mint of the United States, which gave a full opportunity for the display of his special abilities, and through which his reputation was firmly established. Dr. Samuel Moore, then Director, conceived the project of a mission to Europe, for the purpose of examining and reporting on such chemical, mechanical and metallurgic methods and improvements, as might be deemed worthy of introduction into our Mint. He procured the needful authority, and appropriations, and having the fullest confidence in Mr. Peale, selected him as the agent for this purpose. He accepted the trust and sailed for Europe in May of the same year, being officially designated as Assistant Assayer. Mr. Peale remained abroad two years. The subjects of special interest to the Director had been the Sulphuric Acid process of Refining (or Parting,) and the Humid Assay of Silver, on which full investigations were required, but Mr. Peale was not restricted in his inquiries, nor in truth was he one likely to overlook any particulars bearing directly or remotely upon the broad objects of his mission. His intelligent, patient labor, mastered every detail. By partial reports during his absence, but more especially by a full and final report after his return, accompanied by plans and drawings, our Mint was placed in full possession of all that was then worthy to be known of the establishments, public and private, whose organization and methods affiliated them with our own. The direct results of the mission, were the introduction of the humid assay, some improvements in the details of the refining process, and the labor-saving method of duplicating working dies for coinage. The indirect results were perhaps, equally important. For the thoughts and labors of a man of genius in mechanics (as Mr. Peale was,) could not be concentrated on the details of Mint processes, without planning many valuable improvements. Happily for the public service, Dr. R. M. Patterson, the Director who succeeded Dr. Moore, (in July, 1835,) was Mr. Peale's warm friend, and a great admirer of his talents. His "mission" did not cease, therefore, with his return from Europe, but he became associated permanently with the Mint, for a time as Assistant Assayer, then as Melter and Refiner (in 1836), and finally as Chief Coiner (in 1839). His first great work was in the construction of the steam coining presses, substituted for the hand presses then in use. The first steam press was manufactured under his supervision, by Merrick, Agnew & Tyler, and turned out its first specimens in March, 1836. Presses subsequently manufactured for our own and other mints, have been improved in minor points, but their principle of action

remains the same. Other improvements which he introduced, were the so-called milling machine, for raising the edge of the planchet; the steam engines, small and large; the automatic or retroactive return of the draw-bench; and, in particular, the scales for the weighing of gold and silver. These last are models of simple mechanism and nice accuracy. So, in fact, was all of Mr. Peale's work. And we may add, that he brought to all the eye of an artist. It was not enough that a machine should be effective; it must also be graceful and attractive. "Nihil tetigit quod non ornavit." But I cannot enter at large into details of his labors at the mint. I simply add my conviction, (which I know to have been that of the revered Director already named, under whose administration the work was accomplished,*) that without Franklin Peale, the most of that which attracts the admiration of the visitor to the coining department of the Mint would have been wanting. The mark of his inventive genius is here conspicuous, and I have often thought, as I passed through that part of the establishment, how appropriately might be there ascribed to his honor, the words, "Si monumentum requiris, circumspice." But a more competent judge than myself, thoroughly qualified by long experience in mint affairs, has spoken to this point in words which I take the liberty to quote: "It has been my privilege (he says,) to visit the mints of London and Paris, and to witness their inferiority in their mechanical arrangements, to the Mint in Philadelphia. The superiority of our Mint is most manifest in just those points where his hand has touched, and when Americans visiting the mints of Europe, feel a pride in remembering the superiority of their own, they ought to know that to the genius and taste of Franklin Peale are they mainly indebted for it. At the mints of both Paris and London, he was well known and inquired for with interest."

Mr. Peale's connection with the Mint ceased in December, 1854, and he retired for some time from all public employment. In 1864, he was elected President of the Hazleton Coal and Rail Road Company, in the direction of which he had been for many years an active member. He continued in this office until 1867, when he resigned, and finally closed his long career of active business life.

I have thus hastily sketched the professional life of Mr. Peale, by which his public reputation was established; but any notice of his character would be far from complete which left out what we may call its æsthetic side, including those varied accomplishments and elegant tastes, which made him one of the most interesting of men.

We have already referred to the artistic hand which he brought to his mechanical work. This was a characteristic naturally growing out of his strong love and devotion to art. In the society in which he was brought up, —his father and brother eminent as painters,—he came to a knowledge of the subject rare among amateurs. He was for many years a member of the Academy of Fine Arts, which his father had been instrumental in establishing, and for the last fifteen years of his life, one of the Board of Directors, and a member of its most important committees. We are told

*Dr. Robert M. Patterson, the father of the writer, and late President of this Society.

by one of his eminent associates in the Academy, that "he was zealously devoted to the discharge of the duties assigned him, always observing a scrupulous regard for the interests of the contributing artists and pupils of the Academy. His courtuous manners and almost feminine gentleness, made him a great favorite with the lady students especially. He was sincere in the utterance of his convictions, honest in action, and sound in judgment. His taste was refined and his ideas elevated. He was, in short, a most valuable member of the Board. His departure from the scene in which he labored so industriously and efficiently, has created a vacuum not easily filled."

Mr. Peale was an excellent musician, and I believe a self-taught one. He was endowed with a most agreeable cultivated tenor voice, to which the guitar was the appropriate accompaniment, and on which instrument he became a great proficient. His love of music was a passion, and in private circles and public associations he was foremost in promoting its cultivation. His house was for many successive seasons made charming to his friends, as the resort of the best amateur and professional talent of our city, met together to illustrate, in a manner altogether worthy the choicest instrumental and vocal compositions. Mr. Peale was one of the founders of the Musical Fund Society, to which Philadelphia owes so much as the means of spreading a cultivated musical taste among us. He was among the most active members in promoting its objects in art and charity, and at his decease was President of the Society.

In manly accomplishments, Mr. Peale was conspicuous, carrying into these the elegant refinement so marked in his character, and lending also the aid of his mechanical genius. The graceful art of archery was particularly attractive to him, and in his efforts to establish it as an addition to our out-door amusements, I cannot but think he showed a taste and judgment in happy contrast to what has been exhibited in the development of those boisterous and half-savage games, cricket and base ball, of which we now hear so much. He was one of the founders of the club of United Bowmen, and a long series of medals and badges, which he preserved with some pride, attest a skill in which he was confessed the chief. His love of the art and affection for his fellow-members, was shown to the last, for by his special request his remains were borne to the grave by his associates of the club.

In another beautiful gymnastic art, that of skating, he was a proficient from his youth to the last years of his life. And it was, I think, an admirable sight to observe him, when past seventy, moving along with firmness and grace, happy in the enjoyment of his younger friends, and never so pleased as when aiding by his hand or counsel the fairer sex. He was President of the Skaters' Club at his death. And I ought to mention here that Mr. Peale was the inventor of Skaters Reel, a simple expedient for rescuing persons breaking through the ice that has probably been the means of saving many lives.

But the activity of Mr. Peale was by no means limited to his professional duties, or to art and recreation. He was zealous in good works.

In particular, the Pennsylvania Institution for the Instruction of the Blind long engaged his sympathy and unwearied labor. He was elected a manager in 1839, served on its most important committees, and was finally elected President in 1863, holding that office at his decease. He was rarely absent from the managers' meetings, and presided only a few weeks before his death. His tender, affectionate manner made him greatly loved by the pupils, while his intelligence and the soundness of his judgment secured the esteem and confidence of the officers and of his fellow managers.

For some years before his death, Mr. Peale was greatly interested in that branch of Archæology which relates to the so-called Stone Age. He determined to make a collection of implements illustrating that age, and by energy and patience succeeded in accumulating over twelve hundred specimens, many of them very choice. The most of these were gathered by himself at the ancient homes of the Shawnees and Delawares, around the Water Gap where he spent many autumns; others were secured by exchange or purchase. These have all been arranged for easy examination on a plan devised by himself, and full of his characteristic ingenuity and taste, and he has left behind a manuscript catalogue with an introduction and full descriptive details which leave nothing further to be desired. It affords me great satisfaction to add that this valuable collection, the latest labor of Mr. Peale, is to be presented to this Society.

I have left to the close, what perhaps should have been earliest mentioned, all reference to Mr. Peale's association with our own Society. He was elected a member October 18, 1833, and ever after took a constant and active interest in our proceedings. He was for many years one of the Curators, and filled that office at his death. Our published minutes show many communications from him, on a variety of subjects, but of late these were mostly relative to the stone age, on which he was always heard with the interest inspired by his enthusiasm and fulness of knowledge.

Mr. Peale was twice married. By his first marriage, which took place in his minority, he had a daughter, his only child, who still survives. His second wife was a niece of Stephen Girard. She lives to lament the death of her husband, and I may not, therefore, refer more particularly to those accomplishments and virtues by which she crowned his happiness, and made delightful his home.

I have thus far considered for the most part the outer life of Mr. Peale, by which he became known to the public at large, but I cannot conclude without some reference to his inner life as it was disclosed to his more intimate friends. These, while they admired his varied knowledge, saw upon a close inspection other traits which made still more excellent the character of the man. Of these I may mention his gentleness and loving tenderness to all, but especially to the young. With children he was a universal favorite. He never wearied in contributing to their amusement or instruction. And this was no light burden on his time, for a toy from Mr. Peale was not such as comes from the shops, but all that he ac-

complished, from a kite to a complicated engine, was beautiful in form and finish. On occasions, and especially if a charitable object were to be promoted, he would don the costume of an Eastern Juggler, and astonish the young, and even children of a larger growth, with apparently miraculous feats, for which he had constructed apparatus of his own. Even to the brute creation the same tender nature was exhibited. A scientific friend recalls even now the self restraint with which, when a youth, ardent in the search for entomological specimens, he spared a water-spider, of rare species, that had shown a touching instinct in the protection of its young. He was always most ready in imparting information to inquirers whom his happy faculty and clearness in explanation gathered round him. An enthusiastic lover and explorer of nature, it was in the fields and woods that he became perhaps most interesting. He was familiar with the names and habits of plants, animals, and insects, and mineralogy and geology, and from the fulness of his knowledge dispensed liberally.

A marked characteristic of Mr. Peale was his untiring energy. He was never idle, always laboring on some systematic plan. Even his recreations were methodically arranged, and a part of the means by which his body and mind were invigorated for work. And with him there were no *small* duties. Each one was sacred. No temptation or pleasure could induce him to forego a responsibility. A promise was its performance. Punctuality was a prominent virtue, any infringement on which he regretted as wasting another's time.

Finally, Mr. Peale was a reverential, humble, Christian man. A faith better than philosophy sustained him in the closing hour, and he went calmly to his rest murmuring "The Lord is my Shepherd," like unto a little child trusting to a parent's promise. His dying words distinctly and clearly uttered were: "If this is death, it is as I wished, perfect peace, perfect comfort, perfect joy."

The vigorous constitution of Mr. Peale carried him in robust health to a term some years beyond that allotted to man by the Psalmist. For months before his death, however, he was observed to be failing, a fact of which he was himself fully conscious, speaking to his friends with perfect composure of his approaching end. He was nevertheless able, almost to the last, to attend to his accustomed duties, and his closing illness was but a brief one. He died at his residence, 1131 Girard Street, on the 5th of May, 1870, in the 75th year of his age.

ON THREE EXTINCT ASTACI FROM THE FRESH-WATER TERRITORY OF IDAHO. By Prof. E. D. Cope.

(*Read before the American Philosophical Society, Dec.* 16th, 1870.)

Astacus subgrundialis, Cope.

This craw-fish is represented by four specimens, which include the cephalothorax and region of the front, one of them including, also, the post-abdomen to the end, with limbs; three specimens with cheles, one including a pair; and one other specimen representing the post-abdomen.

The prominent characters of the species may be stated diagnostically thus: Two tubercles on each side the front, the anterior spiniform and external to the basis of the lateral ridge of the ensiform process. The latter narrow, medially grooved, acute, with five spinous points on each side, and a terminal recurved spinelet. Surface of the cephalothorax smooth or obsoletely wrinkled. Cheles nearly smooth, not granulate, the superior edge spiniferous. Margins of the segments of postabdomen produced into acuminate plates.

I cannot determine the presence or absence of hooks on any of the legs. The cheles are badly preserved in specimens of this species.

The last segment of the cheles is furnished with a longitudinal series of strong reverted spines along the superior margin. They diminish in length proximally; four or five are most prominent. In a specimen much smaller than the type, where the surface is preserved, it is nearly smooth, and minutely striate. The longitudinal groove of the penultimate joint is well marked; this segment is not spiniferous.

The antennal plates are large, and extend to nearly opposite the end of the ensiform process at the front. The free abdominal segment is punctate on its anterior half. The outer lamina of the postabdominal segment is four times as wide as that of the others, with convex outline to a point directed outwards and backwards. The laminæ of the other segments are acuminate triangular and transverse.

The transverse suture of the external lamina of the flipper, marks the posterior fourth of the whole length of the lamina.

The lateral suture of the cephalothorax is deeply impressed.

Four of the specimens represent individuals of large size: two are smaller. The measurements are as follows:

	M
Length to dorsal suture, No. 1	0.0415
" of ensiform process only	.0182
Width " " at base	.005
Length postabdominal and flipper	.072
" (width) free lamina 1st segment	.013
" outer lamina flipper	.02
" terminal segment flipper	.005
" femur, second pair abdominal legs	.024
" dorsum No. 2 from basal spine to suture	.021

Width basis fixed claw of cheles	.009
Length penultimate joint cheles, No. 3	.0175
Width distal end of same	.0115

In the small specimen (No. 2) it appears to be the inferior margin of the cheles which is spiniferous. The mesonotum is exposed, and is of moderate width.

From a fresh water deposit in the Teritory of Idaho, near Hot Spring Mountain. Obtained by Capt. Clarence King's expedition. Museum Smithonian, No. 9779.

ASTACUS CHENODERMA, Cope, sp. nov.

This species is represented by the cheles of opposite sides of one individual, with which I associate with great probability one from the right side of a second. Part of a cephalothorax of a third is associated, but without conclusive evidence of identity, chiefly because of a near resemblance in the sculpture.

The first mentioned are remakable for their long slender form, and the absence of all spinous armature from their margins. The surface of all parts is covered with thickly placed granular tubercles. The external surface is regularly convex on the middle line, the inner convex on the lower portion, the convexity separated from the lower margin by a groove. Upper portion gradually thinned out to the edge. The edges are simply rugose like the sides, though more coarsely so, with small granular prominences. The denticulation of the opposed edges of this joint are insignificant, though but a small part of the latter is cleared from the matrix.

In the second specimen part of the penultimate segment is preserved. Its inferior margin is unarmed, but on the middle of the outer face is a series of short spines rather distantly placed.

In the third, represented by a cephalothorax, the dorsal suture is regularly convex backwards, and the mesonotum of moderate width. The surface is delicately wrinkled by the confluent bases of fine pointed granules directed forwards. They become more scattered on the sides of the cephalothorax. As in the last species there are two spines on each side the front.

	M.
Length from anterior spine to middle of cross suture	0.0235
Width between posterior spines	.0105
" mesonotum .25 inch from front	.007
Length of last segment of cheles (No. 1)	.045
Width basal part	.0173
" terminal at middle	.006

From Catharine's creek, Idaho; collected for Capt. Clarence King by J. C. Schenk. No. 9779, Museum Smithonian.

ASTACUS BREVIFORCEPS, Cope.

Species nova.

Established primarily on three cheles or last segments of the fore limbs; with these I have associated a cephalothorax of one, and abdominal and

postabdominal regions of three individuals. The only reason for such reference of the latter, is their superficial texture, in which they resemble the cheles, and differ from the corresponding parts in the two other species.

The cheles are short and thick, the section of the stoutest proximal part being an oblique oval. The inferior edge is thinned by longitudinal contraction above and below it. The fixed process is of a rather short conic form. The surface is granular tuberculate, except on the convex faces, where it is finely vermiculate rugose.

	M.
Length last segment cheles,	0.039
Width	021
Proximal transverse diameter	.013

The cephalothorax associated is quite similar to that of *A. subgrundialis*, and may possibly belong to it. It however, differs in the finely vermiculate rugose character of its surface. The rugæ are generally transverse on the back and sides. The supra-anteunal lamina is exhibited in a clear manner; it is as long as the spine of the muzzle, and as wide at the base.

The superior surfaces of the abdominal segments are marked with a delicate vermiculate rugosity, like that of the last specimens. In *A. subgrundialis*, it is impressed punctate. This species also differs from the latter in that the transverse marginal lamina of the first postabdominal segment, is narrower than in the latter, its width not equaling twice that of one of the others, instead of being four times as wide. The succeeding laminæ are acuminate elongate, and slightly curved forward. It is, however, quite uncertain as to whether these postabdominal specimens belong to the species which has the stout cheles. Some of the specimens indicate individuals larger than those referred to *A. subgrundialis*.

From the same locality and collection as the last. No. 9779.

General remarks.

The preceding species differ from those at present inhabiting North America, as I have been able to determine by examining the excellent monograph of the latter, published in the catalogue of the Museum. Compar. Zoology, by Dr. J. H. Hagen. They differ from all of them in the prominence and acumination of the lateral margins of the postabdominal segments. In the serrate simple frontal process, the first described resembles the *Astacus gambelii* Girard, but its process is longer and narrower.

I have already described * twelve species of fishes from the same locality and deposit, whence these Astaci were procured.

* Proceed. Amer. Philos. Soc. 1870, December 8.

NOTE ON SAUROCEPHALUS, HARLAN.

By E. D. Cope, *in the Meeting November* 18, 1870.

Prof. Cope called attention to the cretaceous group of fishes represented by *Saurocephalus* of Harlan. He said they had been regarded as related to the Acanthopterygian family of *Sphyrænidæ*.

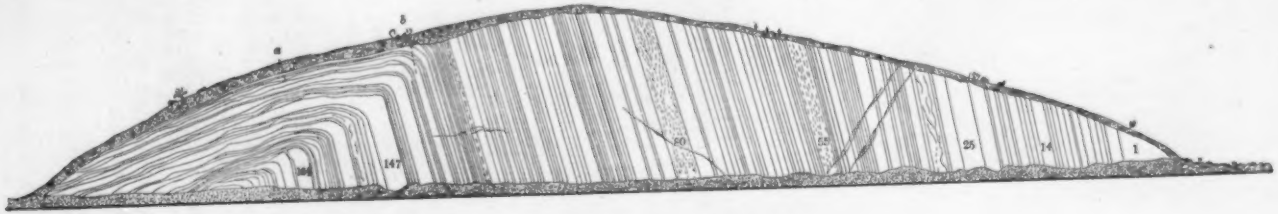
He showed that they were more like certain Malacopterygian families in the structure of the mouth; that the neural arches of the vertebræ were not coössified; and that the tail was vertebrated in a manner between the types of *Salmonidæ* and *Amiidæ*. He said the pectoral rays of the group had been described by Leidy under the name of *Xiphactinus*, and that the caudal rays were remarkably and beautifully segmented. He said that they had been hitherto regarded by authors as spines or rays of the cestracion genus *Ptychodus*.

Prof. Cope also made a communication on the results of the explorations of certain caves in the island of Anguilla in the West Indies, by Dr. Van Rijgersma. He stated that the vertebrata embraced eleven species, of which one was a Crocodilian, two birds, one a deer, and five rodents. Of the latter, three were of gigantic size, including, beside the two species of Chinchillas already described (Proceed. Amer. Philos. Soc., 1869, 183), a third, larger than either, which was named *Loxomylus latidens*, Cope. It differed from the *L. longidens*, Cope, in having teeth with triturating surface less oblique to the axis of the tooth, and wider than long, instead of longer than wide, and with a certain irregularity in the outer margin. The distal end of the femur measured $3\frac{1}{2}$ inches across; the series of superior molars $2\frac{1}{2}$ inches; width of two inferior incisors in place one inch and two lines. The bones of the deer indicated a species a little over half the size of the Chinchilla.

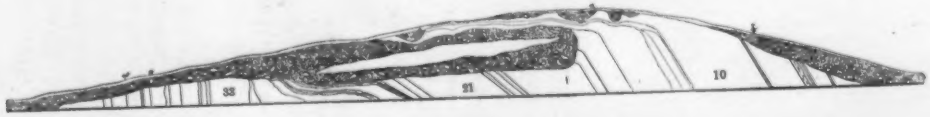
SECTIONS OF TERTIARY ROCK STRATA

In Cuttings of the Union Pacific Railroad, one mile west of Bear River City, Wyoming Terr., U. S.

RAILROAD CUTTING, No. 1 (page 420).



RAILROAD CUTTING, No. 2 (page 424).



INDEX.

BUSINESS.

Annual Elections.....2, 274
Standing Committees.....6, 278
Special Committee on Winchell's Marshall Group..... 24
" " Lyon's New species of Crinoidea..... 24
" " Dewey's Carices.....113, 115
" " Brinton's Cheltic MSS..... 115
" " Horn's Tenebrionidæ..... 146
" " Brinton's Arawack language..... 209
" " Cope's Megadactylus Polyzelus..... 277
" " Fraser's Metallurgical Chart..... 447
" " Maharo and Moska Books..... 515
" " Cope's Ichthyology of the Marañon..... 524
" " The Michaux Legacy, 6, 24, 114, 193, 201, 212, 213, 440, 442, 447
" " Renting the Hall.....13, 84, 93, 111
" " The Michaux Oak Grove and Botonic Garden.....312, 523
" " A Meteorological Observatory.....527, 572
Cleaning and Varnishing the Portraits..... 239
Memorial to Congress respecting the Eclipse..... 13
The Rittenhouse Clock..... 84
The Magellanic premium awarded.....115, 214
Pursh's Botanic Journal returned..... 370
Marianna's History of Spain returned.....3, 14, 192
Comptes Rendus purchased..... 275
Proceedings issued, No. 80..... 3
Appropriations for 1870 made..... 239
The President's resignation withdrawn.....441, 442
Order governing additions to memoirs going through the Press..... 278
Order respecting delinquent subscribers to the Transactions..... 572
Mr. Cuyler's motion respecting the Physical Observatory in the Park..... 572

Members Elected.

Elections.....7, 111, 210, 278, 368, 447, 521

Agassiz, Mrs. Elizabeth, of Cambridge Mass..... 210
Anderson, George W., of West Haverford, Pa..... 211
Baird, Henry C., Philadelphia..... 7
Beadle, Rd. E. R., of Philadelphia.... 447
Binney, Horace Jr., of Philadelphia.. 7
Birch, Samuel, of London..... 7
Blackmore, William, of Salisbnry, (London), England..... 7
Blake, William P., of New Haven, Ct 521
Boekh, Dr. C. W., of Christiania, Norway..... 447
Brinton, D. G., M. D. of Philadelphia. 112
Brugsch, Henri, of Berlin..... 7
Bullock, Charles, of Philadelphia..... 211
Carlier, Auguste, of Paris..... 7
Ceselli, Dr., of Rome..... 7
Chabas, Francois, of Chalons sur Sâone 7
Coffin, J. H. C., U. S. N., Supt. Naut. Almanac, Washington..... 112
Cox, Hon. J. D., of Washington, D. C. 368
Coxe, Eckley B., of Philadelphia..... 521
D'Aligny, Henry F. Q., of New York.. 521
Darwin, Charles, of England..... 210
DeRougé, Emmanuel, of Paris..... 7
Dumichen, Jonannes of Germany..... 7
Flower, William H., of London..... 7
Frauenfeld, George Von, of Vienna.. 211
Gabb, William M., of Philadelphia... 7
Gruner, Louis, Ecole des Mines, Paris 210
Hakakian Bey, of Cairo..... 7
Hale, Rev. E.E., of Roxbury (Boston) Mass..... 278
Hitchcock, Prof. Charles H., of New York City..... 368
Hochstetter, Ferdinand Von, of Vienna..... 211
Hooker, Joseph D., M. D., of Kew Gardens..... 7
Hopper, Edward, of Philadelphia.... 211
Horne, George H., M. D., of Philada. 7
Huxley, Thomas H., of London..... 7
Lartet, Edward, of Paris..... 7
Linant Bey, of Cairo..... 7
Lippincott, Joshua B., of Philadelphia 7
Lyman, Benjamin S., of Philada..... 7
Mariette Bey, Auguste, of Cairo..... 7
Mayer, Alfred M., of South Bethlehem Pa..... 211
Miller, J. Imbrie, of Pennsylvania... 521
Mitchell, Miss Maria, of Vassar College, N. Y..... 210
Naumann, Carl Fr., of Leipsig..... 210
Nillson, Sven, of Lund..... 7
Pepper, Dr. Wm., of Philada..... 447
Phillips, John, of Oxford..... 7
Prestwich, Joseph, of London..... 7
Quincy, Edmund, of Dedham, Mass... 368
Rawlinson, George, of England..... 210
Reeves, Samuel J., of Philada..... 7
Rolleston, George, of Oxford..... 7
Rutimeyer, Carl L., of Basel..... 7
Seidensticker, Oswald, of Phila..... 278
Seiler, Mrs. Emma, of Philada..... 278
Siebold, Carl T. E. Von, of Munich.... 210
Somerville, Mrs. Mary, of England, now of Naples..... 210
Tilghman, W. M., of Philada..... 278
Tyndale, Hector, of Philada..... 7
Tyson, Philip T., of Baltimore..... 211
Vogt, Carl, of Geneva..... 210
Vose, George L., of Salem, Mass..... 521
Wharton, Joseph, of Philada..... 112
White, A. D., President Cornell University, Ithaca, N. Y..... 112
Whittier, John Greenleaf, of Amesbury, Mass..... 278
Williamson, Major R. S., U. S. Engineers..... 368
Worsaae, J. J. A., of Copenhagen.... 7

Photographs Received.

Coffin, J. H. C..... 145
Haven, Dr. S. F..... 514
Horn, Dr..... 368
Jarvis, Dr. E..... 442
Newton, Prof. H. A..... 442
Röhrig, Prof. F. L. O..... 368

Members Deceased.

Bancker, C. N., (obituary read, '85).... 14
Binney, Horace Jr., (obituary read, 371)..... 279
Cassin, John.....3, 23, 110
Clark, Sir James..... 447
Cleveland..... 193
Copland, Sir James, (obituary read, 525) 496
Dorr..... 201
Dunglison, Robley..... 91
Erdmann, A. T..... 275
Grier, R. C..... 514
Meigs, C..... 146
Merrick, S. V., (obituary read, 584)... 496
Paulding, J. K..... 24
Peale, Franklin, (obituary read, 597). 369
Simpson, Jas. Y..... 835
Stevens, Alexander..... 24
Von Martius, C. F. P..... 3
List of surviving members read.....6, 278

Memoirs and Communications.

Ackerman, A.: Meteorological register at Bois-Chêne.....447, 499
Allen, D. H.: On Human osteology.....117, 370
Briggs, H.: On Prof. Henry's meteorological results..... 521
Brinton, D. G.: On the Maya language..... 4
" " Chol and Cokchiquel languages..... 13
" " MSS. Arawak Vocabulary of Schultz.....114, 192
" " Byington's MSS. Choctaw grammar.....280, 283, 317, 442, 516
" " Muskokee grammar..... 301
Chase, P. E.: On Philadelphia life tables..... 13
" Cosmical relations of light and gravity..... 103
" Rain curves..... 113
" Tidal rainfall..... 202
" Solar and electric lights..... 276
" Additional deductions from the rain fall tables..... 279
" The tides..... 284
" Monthly rainfall variations at Philadelphia..... 314
" Comparison of mechanical equivalents..... 313
Creason, J. C.: Profile of the Schuylkill flood..... 209
" Thunder storm of Aug. 4, 1870..... 498
" Description of recent auroras..... 522
Cope, E. D.: On Mylodon Annectens..... 15
" The Cretaceous Tortoises..... 16
" A new Mosasauroid reptile..... 116, 146
" Seventh contribution to the Herpetology of tropical America.... 147
" Synopsis of Extinct Mammalia of the cave formations in the United States, [with three plates]..... 171
" Second addition to the History of the fishes of the Cretaceous of the United States.....194, 212, 240
" Some Etheostomine Perch from Tennessee and North Carolina.. 261
" Some Reptilia of the Cretaceous formation of the U. S.....271, 275
" Molar tooth and fragment of a skeleton..... 278
" Fourth contribution to the history of the Fauna of the Miocene and Eocene periods of the United States..... 285
" Adocus, a genus of Cretaceous Emydidæ..... 295
" Note on Skeletons found near Woodbury..... 310
" Photographic pictures of figures of the human foot on rocks..... 311
" Fossil fishes..... 316
" Vertebræ and other parts of a new species of Bottosaurus..... 367
" Fishes of the Tertiary shales of Green River, Wyoming Ter...370, 380
" A new Chimærid from New Jersey..... 384
" The Lystrosaurus Frontosus 370, 419
" Asteracauthus..... 440
" Triassic Reptilia..... 444
" Some Australian skulls and a Maori skull..... 446
" A partial synopsis of the fishes of the fresh waters of North Carolina.....442, 448
" Llodon periatus, &c..... 496
" Mososaurus Brumbyi..... 497
" The Ichthyology of the Antilles..... 514
" Some remains of a new Cretaceous tortoise..... 515
" The Osteology of Megaptera Bellicosa..... 516

Cope, E. D.: On The Saurodontidæ..... 529
" Fishes of the fresh water tertiary in Idaho, discovered by Capt. Clarence King.....538, 553, 559
" Contribution to the Ichthyology of the Maranon.....496, 559
" Eighth Contribution to the Herpetology of Tropical America, 496, 513, 553.....
" Idaho freshwater fossil fishes..... 571
" Mososaurus maximus, &c..... 571
" The Adocidae..... 547
" Species of Pythonomorpha, from Kansas and New Mexico..... 574
" Fossils from W. India Island caves..... 608
Dubois, W. E.: On Specimen of silver ore..... 92
" Silver Coins struck at the Mint..... 233
" Written communication respecting Lake Superior silver mines 527
Davidson, Geo.: On obtaining the longitude of San Francisco..... 91
Emerson, G.: On an improvement in Whitney's Cotton Gin..... 84
" Robbin's process for preserving wood from mould and decay.. 111
" The part taken by the Am. Phil. Soc. in establishing stations for meteorological observations..... 516
" Information concerning the earthquake of Oct. 20th, 1870.... 522
Frazer, Persifer, Jr.: A chart exhibiting all the metallurgical processes now employed at Friberg, with descriptive text..... 442
Genth, F. A.: On Rhodium Gold in San Domingo and gold sand from the soil of Philadelphia..... 439
" On native lead and iron in gold tailings from Montana Territory.. 443
Halderman, S. S.: On Beads from Indian graves..... 369
Hayden, F. V.: Notes on the geology of Wyoming and Colorado Ter. No. 2...15, 431
" Appendix to his report on Geology of Yellow and Missouri Rivers 112
" Geological map of the Upper Missouri..... 115
" Field notes on the geology of Colorado and New Mexico..... 212, 234
" Description of a large collection of fossil fishes, insects, &c..... 316
" Photographs of fossil fish..... 368
" Three sections of strata belonging to the Bear river group, Wyoming Territory.....370, 420
" Preliminary list of fossils collected in New Mexico and California by F. Bolleck..... 425
" Description of fossil fishes from the upper coal measures of Nebraska..... 431
Horn, G. H.: On the revision of the Tenebrionidæ of America..... 115
Kirkwood, D.: On the periodicity of the sun's spots.....92, 95
" Comets and meteors.....213, 215
" The periodicity of certain rings..... 299
" The mass of Asteroids between Mars and Jupiter..... 498
Lea, Isaac: On thirteen new species of Crinoidea..... 14
Lesley, J. P.: On the Aurora Borealis of April 15th..... 111
" Section across the Allegheny mountains..... 115
" Tornado at Cave City in Kentucky..... 277
Lowrie, W. H.: Some suggestions on the maintaining forces of Cosmical motion 195
" A search for the normal cause of the recession of Cosmical nodes.....213, 220
Marsh: On the meteors of August 24th, 1869..... 194
Marston, Com.: On relics from Vera Cruz..... 83
Mayer, Alfred: Abstract of results of measurements and examinations of the photographs of the total eclipse of August 7, 1869.....202, 204
McClure: Drawings of the appearance of the sun in the eclipse of Aug. 7, 1869.... 202
McNeil: On his Explorations in Central America..... 515
Morton: Pierce's photographs of the eclipse..... 202
Orr, Hector: Extraordinary mildness of the winter illustrated..... 279
" " On the hail storm of May 8th..... 438
Pepper: On a unique case of Universal Hyperostosis..... 571
Porter, T. C.: Indian inscriptions..... 3
Roscoe, Dr.: Letter respecting a supposed Laurentian fossil..... 237
Rothwell: New map of the Anthracite Coal Basins..... 113
Sheafer, P. W.: Boring records in the Anthracite Region.....93, 107
" Coal borings in the Wilkesbarre Basin..... 235
Tyson, Phillip T.: Section of the Cumberland Coal Basin..... 9
Winchell; Alexander: On the Geological Age and equivalents of the Marshall Group, part 1. II, ...15, 57, 245, 275, 369, 385
Wood, G. B.: Indian relics from southern New Jersey..... 213
" Experiments on the revival of peach trees..... 237
" Communications concerning an Indian skeleton..... 283
Wood, H. C. Jr.,: Prodomus of a study of the fresh water Algæ, of eastern North America..... 119
" Concerning recent experiments with Veratria..... 214
" On the medical activity of the hemp plant as grown in North America..... 226
On the fresh water Algæ of the United States.....571, 574

Correspondence:

Prof. Bache's correspondence returned 442
A bronze medal from the Batavian Society of Experimental Science at Rotterdam 282
Prof. Henry, respecting the Byington MSS 385
M. Carlier, respecting the Michaux legacy 514
Dr. Dewey's report on Carices. Letter read relating to 234
Gen. Humphreys' correspondence respecting the geological reports 170
National Telegraphic Storm Survey 278
Philadelphia College of Pharmacy 521
Schimper's Palaeontologie Vegetable 201
Mr. Sullivan to Mr. James, respecting posthumous work by Schwartz, the bryologist. 194

Societies placed on the list of correspondents:

Geological Survey of Sweden 213
Howard University .....
Imperial Central Meteorological Institute 283
Georgia Historical Society 279
Ulm Art and Antiquity Union 524
Meteorological office 116
Montreal Nat. Hist. Society 1, 7, 90
New Bedford Public Library 210
New Observatory at Paris 209
Society of Phy. and Natural Sciences, Bordeaux 3
Surgeon General's office, Washington 1
University of Indiana 280